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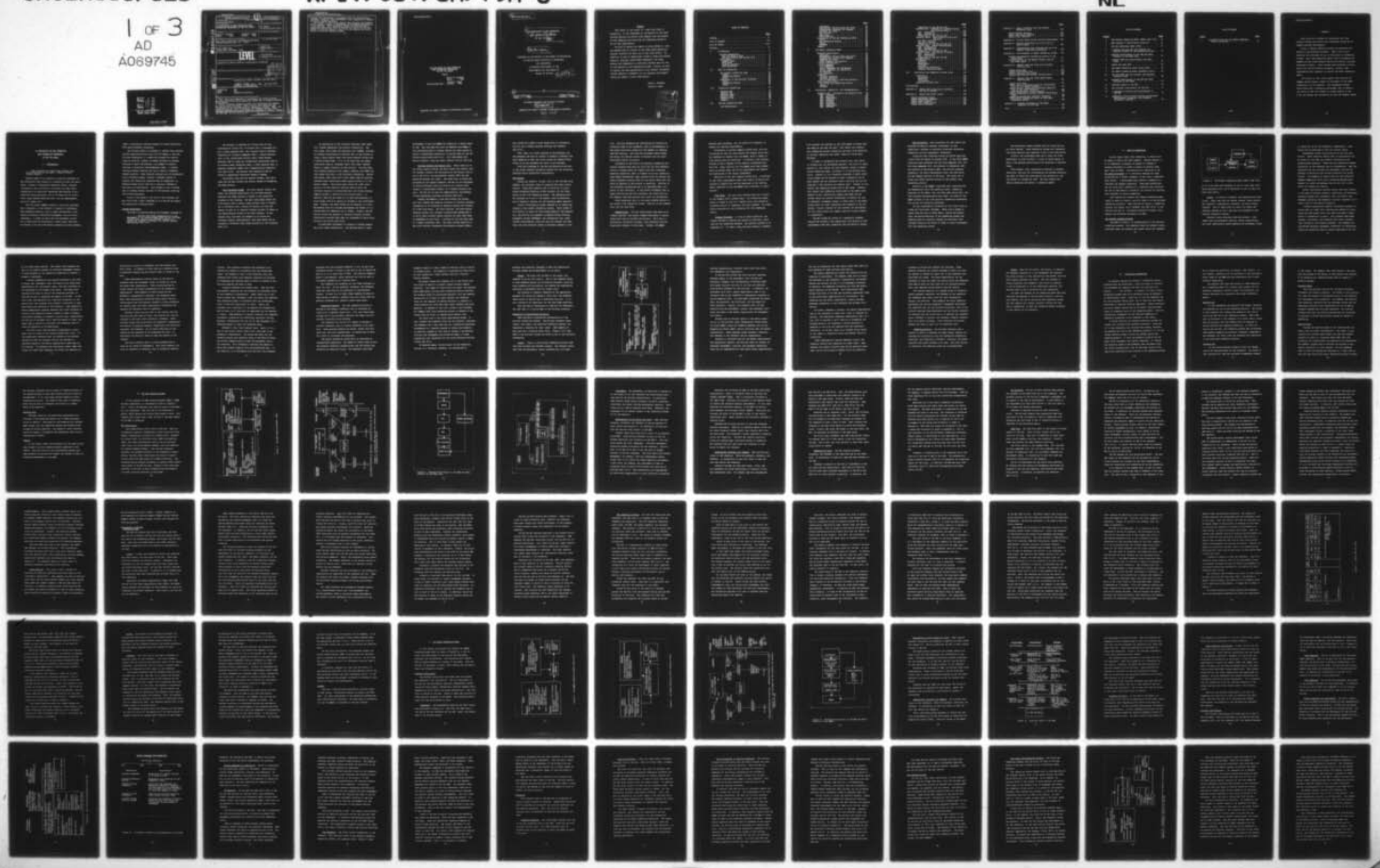

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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: AFIT/GST/SM/79M-6	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): AN EVALUATION OF MAIN OPERATING BASE SCHEDULING PROCEDURES OF THE 552 AWACW	5. TYPE OF REPORT & PERIOD COVERED: MS Thesis
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Larry W. Saunders, Major, USAF; Joseph D. Yount, Captain, USAF	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Air Force Institute of Technology(AFIT/EN) Wright-Patterson AFB, OH 45433	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: 552nd AWACW IOA Tinker AFB, Oklahoma 73145	12. REPORT DATE: March 1979
	13. NUMBER OF PAGES: 218
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Approved for public release; IAW AFR 190-17

JOSEPH P. HIPPS, Major, USAF
Director of Information
23 MAR 1979

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Scheduling
AWACS
E-3A
TAC
SAC
Resource Allocation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This study was conducted to investigate the 552nd Airborne Warning and Control Wing scheduling system and to suggest possible improvements.

First, a General Scheduling Model was formulated and adapted to the military situation. Then a set of five questions was developed for use in evaluation of scheduling systems. Next, the scheduling models used in Strategic Air Command and the 552nd Airborne Warning and Control wing were presented in detail. These

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systems were evaluated in accordance with the five question approach. Finally, some improvements were suggested to improve the AWACW scheduling model.

The results of this study suggest that Tactical Air Command should change a number of procedures if the AWACW scheduling is to be improved. The recommended changes would affect TAC's scheduling philosophy, help to educate all levels of TAC with respect to unique aspects of the E-3A, and improve the utilization of this new weapons system.

AFIT/GST/SM/79M-6

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THESIS

Larry W. Saunders
Major USAF

Joseph D. Yount
Captain USAF

AFIT/GST/SM/79M-6

Approved for public release; distribution unlimited

(14) AFIT/GST/SM/79M-6

(6) AN EVALUATION OF MAIN OPERATING BASE SCHEDULING PROCEDURES OF THE 552 AWACW

(9) Master's THESIS,

Presented to the Faculty of the School of Engineering

of the Air Force Institute of Technology

Air University

in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

(12) 217 p.

by

(10)

Larry W. Saunders
Major USAF

Joseph D. Yount
Captain USAF

Graduate Strategic and Tactical Sciences

(11) March 1979

Approved for public release; distribution unlimited

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Preface

This thesis is the result of a year long study of scheduling. It was undertaken at the request of the 552nd Airborne Warning and Control Wing (AWACW) with the purpose of both examining and improving the scheduling system in use at that organization.

We wish to express our thanks to Major Edward W. Jones and Captain Paul A. Cousins of the 552nd AWACW Operations Analysis division for their aid in the study effort. In addition, we want to thank Major Joseph L. Rooks and Captain Ernest R. Jennings, 552nd AWACW schedulers, for their efforts and cooperation in providing valuable data for use in the analysis of the scheduling system. Finally, we wish to express our deep appreciation to our advisor, Lieutenant Colonel Charles W. McNichols for his guidance and support during all phases of this study effort.

Larry W. Saunders

Joseph D. Yount

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ABSTRACT

This study was conducted to investigate the 552nd Airborne Warning and Control Wing scheduling system and to suggest possible improvements.

First, a General Scheduling Model was formulated and adapted to the military situation. Then a set of five questions was developed for use in evaluation of scheduling systems. Next, the scheduling models used in Strategic Air Command and the 552nd Airborne Warning and Control wing were presented in detail. These systems were evaluated in accordance with the five question approach. Finally, some improvements were suggested to improve the AWACW scheduling model.

The results of this study suggest that Tactical Air Command should change a number of procedures if the AWACW scheduling is to be improved. The recommended changes would affect TAC's scheduling philosophy, help to educate all levels of TAC with respect to unique aspects of the E-3A, and improve the utilization of this new weapons system.

AN EVALUATION OF MAIN OPERATING BASE SCHEDULING PROCEDURES OF THE 552 AWACW

I. Introduction

"The instruments of battle are valuable only if one knows how to use them." Ardant du Pilq, 'Battle Studies'.

Optimum usage of any resource is directly dependent on how effectively that resource is scheduled to meet the user's needs. Without a coordinated scheduling effort, improper allocations, poor utilization, and misuse can take place. Scheduling is of particular importance when applied to aircraft and flying personnel, due to the high cost of an aircraft, high systems operating costs, and the immeasurable value of a human life.

The E-3A Sentry (AWACS) presents a difficult challenge for a scheduler, as the aircraft is capable of performing many different missions, such as radar surveillance, intelligence collection, battlefield management, and air-to-air intercepts. In order to allow the crew personnel to maintain a high level of proficiency in these areas, they must be trained in all the E-3A mission scenarios and must operate

under a continuation training program to ensure familiarity with these different situations.

The training effort is enormous; a typical crew training mission requires activity with a KC-135 tanker, a time and altitude reservation in a specified airspace for certain types of activity, fighter or bomber resources to provide training in many E-3A missions, and jammers to provide training in electronic countermeasures (ECM). A typical training scenario requires the use of twelve to eighteen fighter aircraft. Each external resource must be coordinated with a different agency, usually a calendar quarter in advance; the timing and locations must be compatible, to minimize wasted flying time and to provide a maximum of activities on each mission. This process is not a trivial one; an average quarter consists of 150 missions involving 1420 E-3A flying hours.

To get a firm grasp of the size of this problem, one must first have a basic knowledge of an E-3A and the people who require this training effort.

Systems Description

The E-3A is a modified Boeing 707 airframe, designed to

> . . . provide world-wide responsiveness in the employment of its unique capabilities for all altitude surveillance, warning, and aircraft control in a variety of tactical, strategic, and special mission applications (Ref 9:2).

The aircraft is operated by a flight crew of four, consisting of a pilot (P), a co-pilot (CP), a navigator (N), and a flight engineer (FE), and a mission crew of thirteen, consisting of a mission commander (MCC), a senior director (SD), an air surveillance officer (ASO), three weapons directors (WD's), three air surveillance technicians (AST's), an airborne radar technician (ART), a radio operator (RO), a computer technician (CDMO) and a communications technician (CT) (Ref 21:13). The mission crew composition may be varied if operational conditions warrant a change.

The mission crew uses two special systems, the E-3A's radar and the data display and control system to accomplish the AWACS mission.

The E-3A Radar System. The first special system, the radar, was designed specifically for the broad mission spectrum; the radar antenna is housed in the large disk attached to the fuselage. The many radar modes enable the E-3A mission crew to detect enemy aircraft both in azimuth and in elevation over a variety of terrain and over sea states, as well as to identify friendly aircraft by means of the identification friend or foe (IFF) feature. On any azimuth scan, the radar can examine up to thirty-two different sectors simultaneously; then each sector can be analyzed in different radar modes according to the situation (Ref 9:7).

An explanation of the currently available radar modes will further demonstrate the system's versatility. The first mode, Pulse Radar Non-elevation Scan (PDNES), provides for azimuth surveillance of aircraft down to the surface by using a pulse doppler radar with narrow doppler filters and a narrow antenna beam. It is to be noted that the highly directional beam has extremely small side lobes, thereby making it highly resistant to ECM activity. The next mode, Pulse Doppler Elevation Scan (PDES), operates like PDNES and adds target elevation to the available information. Beyond-the-Horizon (BTH) mode uses a pulse radar beam and provides extended range surveillance where ground clutter is in the horizon shadow. The passive mode allows the radar transmitter to be shut down for selected sectors while the receivers continue to process ECM data; the system displays jamming strobes in both active and passive modes. In addition, PDES and BTH modes can be used simultaneously or alone either active or passive as desired in the interleaved mode. Further, the radar system can be operated in a Test/Maintenance mode for inflight maintenance and checks or in a standby mode for immediate use if needed. Finally, the IFF feature allows the operator to identify friendly aircraft from hostile aircraft when they are intermixed as would occur during an air battle (Ref 9:23).

An additional refinement is planned to further enhance the E-3A's radar capabilities. The maritime mode is under

development to give the AWACS the capability to detect ships at sea. This new mode will also be combined with PDNES in the interleaved mode to further improve the radar system by giving a simultaneous capability to provide both air and sea surface surveillance (Ref 9:12). This improvement will serve to ensure a long and useful service life for the E-3A.

The Data Display and Control Unit. Radar inputs go to the second special system, the data display and control unit, for storage, display, and utilization by the mission crew on one of two units, the multipurpose console (MPC) and the auxiliary display unit (ADU). The radar data is stored and processed by the onboard computer; the MPC can be configured to utilize pertinent data and function as a battle staff console, a surveillance console, or a weapons director console. The ADU can be used for communications, maintenance, or data processing functions as desired (Ref 9:8).

Further refinements to the data display and control unit will enhance the existing functions by allowing valuable information to be displayed to agencies outside the aircraft on a real time basis. The first addition, the data display remoting system, will transmit pictures from onboard MPC's to one or more tactical ground stations for real time relay to commanders at any level. A variety of this has been used in a highly successful test. The other planned addition is the Joint Tactical Information Distribution System (JTIDS);

this system will permit a high volume flow of information and will use a spread spectrum technique for security (Ref 9:13).

This, then, is a brief overview of the machinery and the operators who must be trained to properly interface with their machines so that the entire system can operate effectively up to the standards for which it was designed.

With this knowledge of the men and machine we now turn to the actual resource allocation process and the situations revealed during preliminary investigation.

The Problem

During the analysts' initial visit to the 552 AWAC Wing (AWACW), two different areas of research were under consideration. These were possible uses of the E-3A in a post-Single Integrated Operation (SIOP) scenario and the examination of the E-3A scheduling system. The scheduling area was selected as it was in the authors' area of experience and of immediate interest for the expanding AWACS operation.

Initial investigation showed symptoms of an underlying problem in the overall scheduling process. There seemed to be virtually no record of crew accomplishments; the computer aid, the Tactical Air Command's Automated Flight Training Management System (TAFTRAMS), was unresponsive and, under further investigation, could not give any insight into what items the crew personnel needed to maintain currency in the

E-3A. The wing scheduler was contracting for sorties and allocating them to the squadrons, with no consideration to the actual activities needed for crew members to complete required training. Each crew was allocated three flights per month, two mission sorties (M-Sorties) and one pilot proficiency sortie (P-Sortie).

Attendance at the first E-3A quarterly scheduling conference revealed that many TAC units did not send representatives, although every TAC fighter unit has a Directed Operation Capability (DOC) to conduct air-to-air operations. Some Higher Headquarters (HHQ) agencies were not present and others supplied incorrect data for the actual dates the E-3A would be required to participate in exercises. Portions of the conference proceedings had to be reaccomplished, as a result of this oversight. At the second conference some of these deficiencies had been corrected, but others had not. For example, some HHQ agencies were still not represented.

These operations point to two major problem sources in the overall E-3A scheduling system. They are at the command level and the wing level.

Command Level. TAC has traditionally been made up of fighter aircraft; the overall command philosophy is geared toward this type of aircraft and mission. The E-3A is a multiengine, multiplace aircraft, very different from the single-seat fighter in both areas. Further, the AWACS

requires many resources, such as tankers and fighters, to support its training requirements.

Utilization is another command problem area; this was illustrated by the fact that several TAC fighter units were not scheduled to operate with the AWACS, while a number of E-3A sorties were not fulfilled. In addition, the training syllabi of TAC's fighters do not require interfacing with the E-3A. Their activity with the AWACS would help fighter units to satisfy their air-to-air requirements and improve the proficiency of the Sentry crewmembers.

Education is the last command problem area. A knowledge of the E-3A's requirements would help others to realize the aircraft's capabilities and the magnitude of the training effort required to keep the AWACS crews proficient in their mission.

Wing Level. The wing level problem areas are a result of the command level problem areas. The scheduling organization is based on that of a fighter wing; wing scheduling allocates sorties to schedulers for each squadron. No single office possesses all the information for the scheduling effort.

Problem Statement. In view of these situations, the authors decided to address the problem of defining a structure for the scheduling problem. The specific problem to be addressed is: "Is there a more efficient method to schedule

E-3A aircraft and aircrews of the 552nd AWACW to better meet the needs of the USAF and TAC?" This thesis will address only scheduling actions concerning the wing's E-3A squadrons at the main operating base (MOB), Tinker Air Force Base, Oklahoma.

In order to accomplish the research task, this thesis is divided into six succeeding chapters. The first of these, Chapter II, will define the term schedule, explain a generalized scheduling model, and adapt it to the military situation. Chapter III will establish standards by which scheduling systems can be analyzed so that a comparison can be made between the one presently used at the wing and the one employed in the Strategic Air Command (SAC). Chapter IV will explain the scheduling system used by SAC today. Chapter V will explain the scheduling system used by the AWACW today. Chapter VI will evaluate and compare the AWACW and SAC systems using the criteria established in Chapter III and, if necessary, recommend changes to those areas in the AWACW system which are rated inadequate when compared to the SAC system. Finally, Chapter VII will present the conclusions for this study effort and suggest areas for future studies, if appropriate.

The SAC system was chosen as a comparison standard because the aircraft, crew composition, and variety of crew requirements were most compatible with the Sentry's system.

Data Collection. Data collection for this effort was conducted by means of personal interviews, on-site inspections, searches of available literature concerning scheduling, and the researchers' experience.

Interviews were conducted during the period beginning 1 March 1978 and ending 15 October 1978. At the 552nd AWACW, interviews were conducted with the Wing Commander (CC), the Vice Wing Commander (CV), the Director of Operations (DO), the Director of Maintenance (DCM), the wing and squadron schedulers, the wing's maintenance staff, the crew force, and the command sections of the wing. The intent was to obtain the widest possible picture of the overall wing scheduling process.

External to the AWACW, interviews were conducted with the Headquarters TAC E-3A operations staff, scheduling personnel at the 380th, 5th, and 509th Bomb Wings (SAC), the 55th Strategic Reconnaissance Wing (SAC), and users of the AWACS services at two E-3A quarterly scheduling conferences and one SAC air refueling conference.

On-site investigation consisted of five field trips to Tinker Air Force Base, Oklahoma. These visits ranged in length from two days to three weeks. During the longest stay, the entire evolution of the scheduling process was observed from its inception through its execution; this included flying on one sortie in order to fully investigate the E-3A scheduling system.

The publication search covered both Air Force and non-Air Force sources. Other scheduling systems and viewpoints from other agencies were examined to aid in the study effort.

Finally, the researchers made use of their Air Force experiences in large aircraft, a total of twelve years, to help in the problem identification and selection of relevant ideas.

This chapter, then, presented an overview of problem definition, the plan for investigating the problem situation, the order in which the investigation was carried out, and the sources of information used. The next chapter will define scheduling and explain a scheduling model.

II. What is Scheduling?

As this thesis deals with scheduling, it would first be useful to define the term schedule. Webster defines it as "a timetable; a program; an agenda or a method of resource allocation in order to obtain or maintain some goal" (Ref 34:2028). The definition as specified in the Air Force Dictionary is "a tabulation showing the times postulated for a flight, movement, or the like; a timetable" (Ref 32:456). A businessman would define a schedule as a timetable for company operations. From these definitions one can infer that a schedule is a timetable that optimizes the use of some agency's resources; the process for deriving this timetable is called scheduling.

This chapter will explain the General Scheduling Model (GEMS) as shown in Figure 1 and will adapt it to the military scheduling situation. GEMS consists of inputs, a scheduling process, the output, and a feedback loop (Ref 33:6); it was derived from Ref 33. Continued reference to Figure 1 will enhance the following explanation of GEMS.

The General Scheduling Model

The GEMS in Figure 1 is representative of any resource allocation process. The scheduler takes the system's inputs, processes them, and produces the output called the schedule.

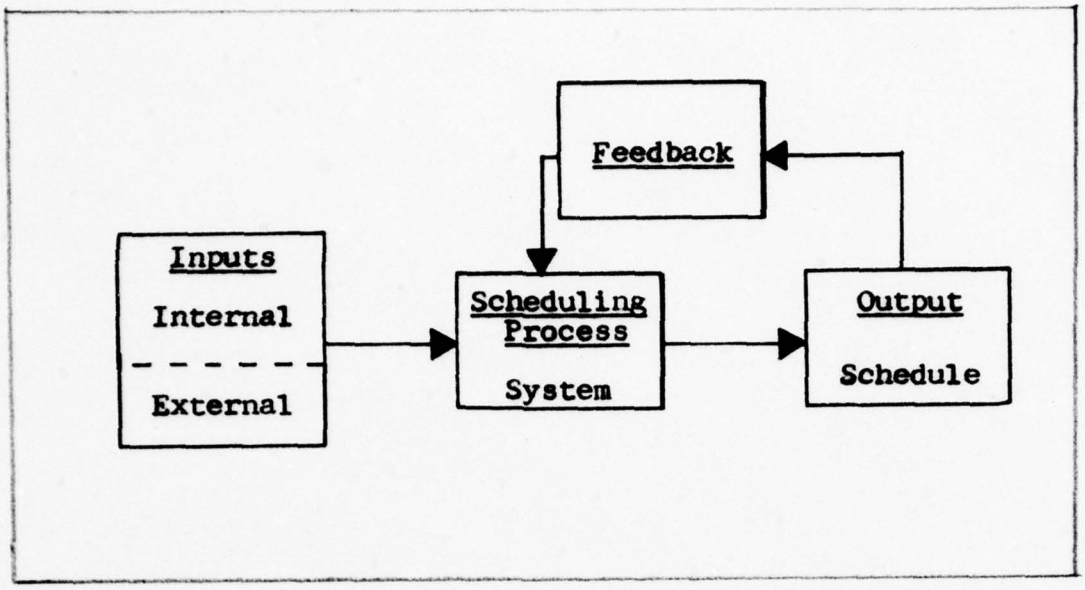


Figure 1. The General Scheduling Model (GEMS) (Ref 33:6)

It is to be noted that feedback is also an input (Ref 33:6). These components will now be explained in turn to point out their many facets.

Inputs. To develop a schedule, the scheduler must have inputs. These come from two general sources, those outside the scheduler's organization, external, and those within, internal. Both of these types of inputs can affect the schedule; because of this, they must be considered in the resource allocation process.

External inputs originate from many sources. Some common ones are government agencies, parent organizations, and other organizations whose resources are purchased, hired,

or leased for use by the scheduler's organization. Each source will be explained to show its typical inputs.

Governmental inputs consist mainly of laws and regulations. These typically specify what an organization can or cannot do, and they are normally incorporated into organizational guidance. These laws and regulations become constraints on the scheduler and his organization. When the guidelines are not followed, the government notifies the offender of deviations and assesses penalties for noncompliance. Two examples of these inputs are the Interstate Commerce Commission (ICC) rules concerning maximum gross weights for trucks and maximum time per day that a truck driver can operate his vehicle.

Parent organizations provide inputs, which are usually in the form of guidance (manuals, regulations, and policies), resources (money, men, equipment, time, and space), and feedback concerning the scheduler's agency's operation as it forms a part of the overall operation.

A parent organization supplies centralized guidance to ensure that its lower level organizations operate in accordance with the overall plan; this helps the parent organization to accomplish its goals. This guidance from above becomes a constraint; the scheduler must form a schedule that conforms to the external guidance. Two examples are centralized personnel management directives and centralized production guidelines from the parent organization for use

by its lower-level agencies. The higher level managers may want to use specific methods of personnel management because of union troubles or set production guidelines to control a product's uniformity.

A parent organization may provide resources in the form of money, men, equipment, time, and space to the lower-level organizations for utilization; again, this may contribute to the attainment of the higher level goals. The lower-level schedulers may have to use all the resources provided, or they may be able to negotiate the amount to be used. In the first case, the resources are a definite constraint; in the second case, the resources could become a constraint if they were scarce and essential to the operation. Some examples of parent organization supplied resources are funds allocated as a part of the budgeting process, workers to make a product, specialized equipment to produce a certain item, authorization for the use of equipment for a specified amount of time, computer time to control an inventory, and warehouse space to store raw materials or finished goods.

The final input from the parent organization is feedback; this is a part of the control process (Ref 33:6). If the lower-level operation does not conform to the external guidance or does not properly utilize the assigned or bartered resources, the parent organization's goals may not be attained. Its managers note deviations, report them, and inform the lower-level managers, who direct the scheduler to

take action to return to conformity with the overall plan (Ref 37:620). An example of this would be a deviation from a production schedule and the actions taken to return to the plan.

Other organizations provide inputs in the form of resources that are purchased, hired, or leased for use by the lower-level organization. Their acquisition may be either through the parent organization or the scheduler's organization. Some examples of these inputs are raw materials, transportation resources, and warehouse space. Here, both organizations accomplish their goals; the procuring agency uses the external resources to help accomplish its overall plan; the other organization incorporates the requests for resources into its operation.

External inputs are only part of the system; they are used with the next type of input, the internal one, and are included in the lower-level operation's schedule. These internal inputs come from within the scheduler's organization and consist of guidance (manuals, regulations, and policies), resources, and feedback. All of these items must be considered by the scheduler as he formulates his plan. An explanation of each will show how they are related to the schedule.

The first internal input is called guidance and is given by all levels of management. This input normally consists of preferred or mandatory ways to accomplish specific

actions. This guidance constrains the scheduler as he derives his schedule in accordance with the established plans. One example of this is the production plan; the scheduler must ensure that adequate personnel are assigned to accomplish the required tasks in order to conform to the plan and complete the work on time.

Internal resources are another input. They are like the external resources but are procured and allocated solely by the scheduler's organization. These inputs are in the form of money, men, equipment, time, and space; the scheduler must manipulate these in accordance with the established plans to help his agency meet its goals. Again, the resources are a constraint if the amounts are assigned and must be used, or if they must be negotiated and the resource is scarce. Some examples of internal resources are budgetary allotments, production and supervisory personnel, milling machines, authorization for the use of some equipment for a specified amount of time, and warehouse space.

Feedback is the final internal input. Again, it is a part of the control process (Ref 33:6), this time in the scheduler's organization. The people who carry out the schedule provide this important input in the form of verbal and written communications to both the management and to the scheduler. This information indicates the degree to which the schedule complies with the established plan. If the operation is in accordance with the plan, the scheduler

continues with the proposed schedule; if not, he must take corrective action to return to the plan or act to change the plan if it is in error (Ref 37:650). The previous examples given in the external inputs narrative can also be used to illustrate feedback on an internal basis.

The scheduler now possesses all the items necessary to begin his task. He has guidance, resources, and feedback; these may come from his own operation or from external sources. He must now fit these items together by means of some process to derive a schedule that will ensure that all agencies concerned will progress toward their goals.

Scheduling Process. The term scheduling process is defined as the method a scheduler uses to transform his inputs into a feasible output plan. This plan should make optimum use of the available resources and comply with all pertinent constraints and guidance.

The scheduler can use any of a number of methods to allocate resources; this is usually specified in his guidance. Three possible methods are manual, manual with computer aid, and fully computerized. An explanation of each will serve to illustrate the processes.

The manual scheduling system would be applicable to uncomplicated operations. The number of inputs would be few, the guidance relatively uncomplicated, and the various combinations of resources finite. The scheduler could make

tradeoffs based on a small number of decision rules to derive an optimum output. Two examples of organizations which could use this method are a small machine shop and a tactical fighter squadron.

The manual system with computer aid is the second type; this would be used by a slightly larger and more complex operation. The number of inputs would be larger, the guidance more complicated, and many more scheduling options available. The schedule might be constructed manually, with the computer serving only as a place to store records; the scheduler could use the computer for making decisions in addition to record keeping and could make some simple tradeoff decisions manually. An example of the first system is the Strategic Air Command (SAC) wing scheduling system; an example of the second could be found in a medium-sized machine shop.

The third type is the fully-computerized system. In this instance the scheduler would put his guidance, resources, and feedback into a data base and use a scheduling algorithm, implemented as a computer program to develop the schedule. An excellent example of this type of system is the National Airlines Fuel Management and Allocation Model, a linear program for fuel purchasing for the entire National Airlines system (Ref 36:1).

By whatever means, the end result of the scheduling process is a "feasible" schedule, one constrained by

guidance and resources, designed to keep the organization directed toward the accomplishment of its goals.

Output. The final part of GEMS is the output, the schedule to be put into action. This is the tangible result of some reasoned process for allocating resources, using the given guidance and constraints, and keeping the organization operating in accordance with its overall plan.

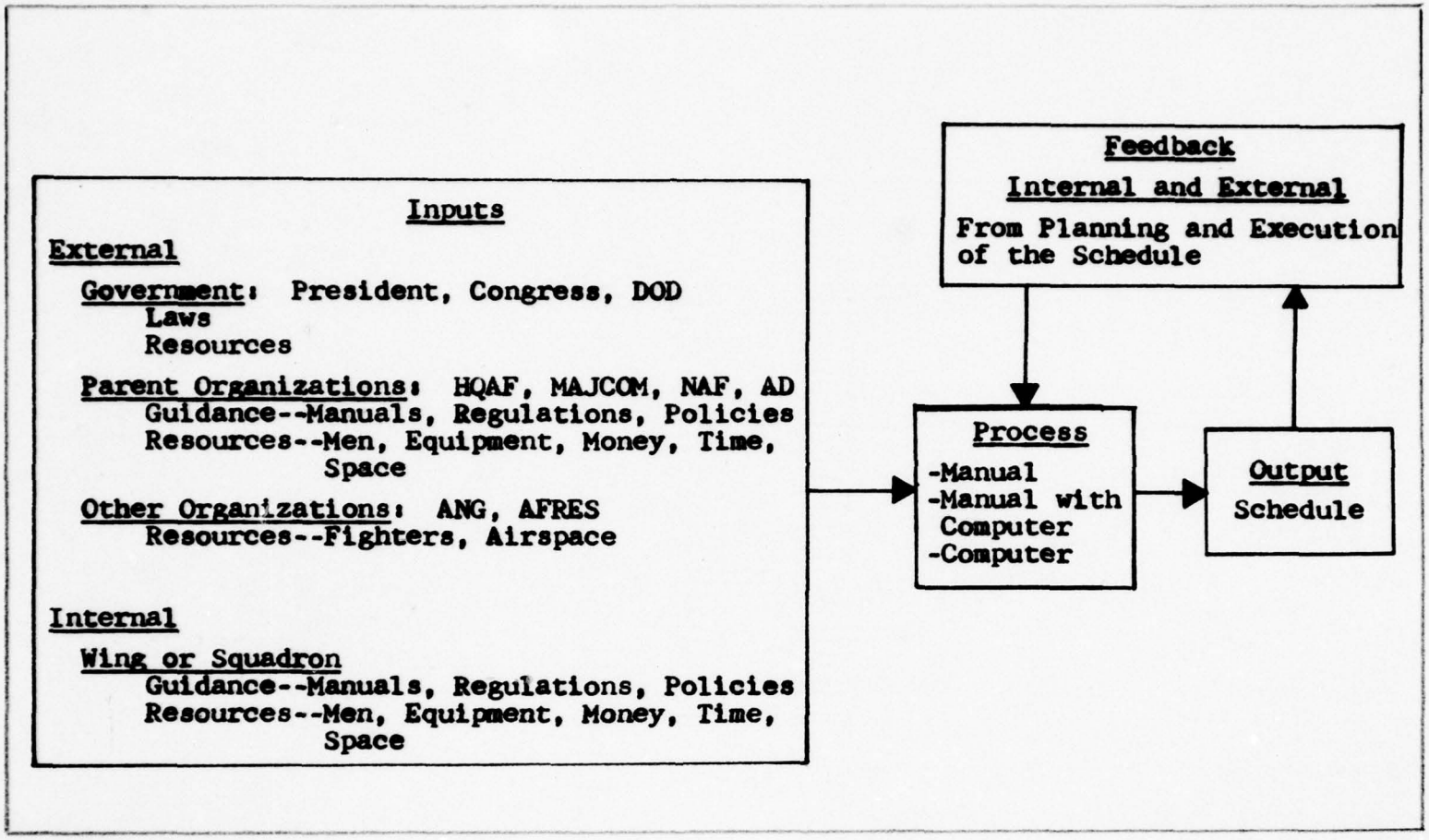
The schedule is normally submitted to the appropriate managers for review and approval; after this, the scheduler takes action to publish and to distribute the plan. It is now a directive for operations for the time frame specified.

This has been an explanation of GEMS and its components; the next task is to relate GEMS to the military situation.

Adaptation to the Military Situation

GEMS provides an appropriate representation of the military scheduling problem. The military scheduler takes inputs, uses them in the specified scheduling process, and formulates a schedule for their usage. Some examples of each area will illustrate these facts. Figure 2 will show GEMS in the military context and serve to aid in the following explanation.

Inputs. Inputs to the military scheduling process come from both internal and external sources. The external inputs come from the government, parent organizations, and other



(Ref 33:6)

Figure 2. GEMS Adapted to the Military Situation

external organizations; internal inputs come from within the scheduler's own organization.

In the military system the first and most important external agency is the government; this includes the President, Congress, and the Department of Defense (DOD). This agency supplies the laws of the land and specifies broad mission guidance for the military. In addition, the government acts like a parent organization; many of the resources used by the scheduler's organization originate in the governmental area. The government authorizes the equipment, the personnel, the facilities, and the budget for their operation. However, the scheduler does not deal directly with the government; instead, the government allocates the items to the parent organizations for management and control.

Another type of external agency is the parent organization; in the military sense, Headquarters United States Air Force (HQAF), Major Air Commands (MAJCOM) such as SAC, Numbered Air Forces (NAF), and Air Divisions (AD) are parent organizations. These agencies supply guidance, resources, and feedback to the scheduler and his organization.

Guidance is available from all the parent organizations. The regulations, manuals, and policies cover all aspects of personnel management, training, and equipment operations; these may be supplemented by lower-level parent organizations.

The list of references for this thesis shows that there are many examples of these military publications.

The parent organizations supply the resources for the scheduler to manipulate. For example, HQAF acts to assign the personnel to the scheduler's organization; the MAJCOM assigns the aircraft as part of its management processes. In addition, the budgetary allocations go from the governmental agencies to the MAJCOM. This organization then assigns the funds to the NAF who allocates operational funds to the lower-level organizations for utilization. The scheduler and the parent organization, usually the NAF, exchange information to help determine the airspace allocations.

Of course, feedback is present; the parent organizations come to the scheduler at least once a year to evaluate his program. The Operational Readiness Organization (ORI) is a tool used to evaluate a unit's ability to accomplish its assigned mission; the scheduler's entire operation is examined to see if he has complied with the applicable directives. If he has, there is no further action taken; if not, there is corrective action and several follow-up inspections.

Other organizations provide important inputs; the scheduler usually must negotiate for these items. Some examples are fighter aircraft from the Air National Guard (ANG) and Air Force Reserve (AFRES) units and operating

airspace to utilize the fighters for training. These external resources are usually arranged at least one calendar quarter in advance of their use, so the scheduler must anticipate his needs. The other organizations use the resources to train for their own mission while the scheduler uses them to help his unit train for its assigned mission. Then, both agencies derive benefit from the process.

The internal agencies, for example wings or squadrons, supply guidance, resources, and feedback to the scheduler. The scheduler must comply with the local regulations, manuals, and policies. Some examples are local operating procedures and the wing commander's management philosophy. The scheduler must use the resources available, such as the aircraft obtained from maintenance and the aircrew resources as obtained from the flying units, to generate the schedule. Again, feedback is present; the scheduler normally receives this if he makes a mistake. Staff personnel and aircrew members are quick to point out an infeasible plan.

Scheduling Process. The military scheduler uses a process to derive a schedule; he takes inputs, applies the guidance and constraints, uses the appropriate scheduling algorithm, and formulates a schedule. Normally, the MAJCOM specifies the actual process to be used. Once this portion is completed, the remaining steps can be accomplished.

Output. When the end result, the output, is compiled, the scheduler presents it to the management for approval. The actual process is also specified by the MAJCOM, with the local agency providing the place. When the schedule is finally approved, the scheduler takes action to publish it and to distribute it to the appropriate agencies; the approved plan is now a directive for unit operations.

Now that the elements of the scheduling model have been explained and adapted to the military situation, only one task remains, the one of evaluating the scheduling system. The next chapter will explain relevant criteria for this type of comparison, so that the scheduling models presented in this thesis can be evaluated.

III. Evaluation Methodology

To properly analyze and evaluate a scheduling system, standards must be established. These are known as criteria, "the standards for judging; the rules or principles for testing . . . " (Ref 34:538). In general, Air Force flying scheduling systems seem to be evaluated using two measures of effectiveness (MOE). These are 1) "Did the scheduler use all the allocated flying time?" and 2) "What was the overall percentage of required training completed?" These indicators give only overall results and do not permit detailed examination of component parts of the scheduling model. They are consequently inadequate for the detailed comparison of scheduling approaches to be attempted in this thesis.

To better evaluate and compare scheduling systems the authors will consider five pertinent questions. These are 1) "Is the information and resource flow timely, accurate, and adequate for use by the scheduling process?", 2) "Is the system flexible enough to allow for changes during the planning phases?", 3) "Does the guidance supplied for the model force systematic and logical planning?", 4) "During the execution phase of the schedule, does the model allow for timely rescheduling?", and 5) "How many levels of the particular organization are involved in the scheduling effort

and is there any duplication of effort?" (Ref 39:165). In this chapter, questions will be explained in turn and appropriate areas of the GEMS military application will be mentioned as applicable.

The analysts feel that the answers to these questions for a scheduling model will provide some insight into its important components, provide a means for evaluation, and provide some means for comparison with other scheduling models.

Question One

"Is the information and resource flow timely, accurate, and adequate for use by the scheduling process?" The answer to this question will capture the essence of the flow of inputs for the use in the scheduling process. Many items must be available to the scheduler on a timely basis, inputs must be accurate, and their amounts must be adequate to ensure efficient and complete scheduling. If these conditions are not met, the scheduling process may be hindered. Some general examples are guidance, resources, commitments, and feedback, all those items the scheduler must manipulate in the particular scheduling process.

Question Two

"Is the system flexible enough to allow for changes during the planning phases of the schedule?" The answer to this question will show how the model accommodates changes

to the inputs. For example, what would happen if the guidance was altered or the amount of some resource was changed? To be effective any scheduling model must be capable of handling changes.

Question Three

"Does the guidance supplied for the model encourage systematic and logical planning?" The answer to this question will show the essence of the guidance given to the scheduler for development of his schedules. For example, are specific time guidelines specified for the necessary actions and are appropriate decision rules established for use in making tradeoffs between men and other resources? The analysts strongly feel that the planning process must be structured by guidance to ensure good planning during all phases of scheduling.

Question Four

"During the execution phase of the schedule does the model allow for timely rescheduling?" The answer to this question will provide some insight into the time element required to react to a situation where some event was scheduled, not accomplished, and required to be rescheduled. For example, suppose that an aircraft was delayed on the ground, resulting in a late takeoff. Can the scheduler react to this and procure new resources at a later time so that the crew could still have a productive mission or delay

the external resources such as tanker or fighter aircraft in the operating areas so that some training activity could be accomplished? If so, this might prevent changes to other scheduled activities. The analysts feel that a scheduling model must be able to reschedule activities on a timely basis to be effective.

Question Five

"How many levels of the particular organization are involved in the scheduling process and is there any duplication of effort?" The answer to this question will provide some insight into the scheduling process and actions accomplished by various agencies. The number of levels involved should be enough to accomplish the appropriate tasks with no duplication of effort.

Summary

In this thesis these five questions will be used to gain some insight into the scheduling models presented in the thesis. They will also use the understanding gained from each question to evaluate and compare the systems so they can recommend improvements to the ASM.

IV. The SAC Scheduling Model

In this chapter the SAC Scheduling Model (SSM), a GEMS military application, is presented as shown in Figures 3 and 4. First, the agencies that provide inputs to the model will be introduced. Then the SSM will be explained in detail, while showing the various participant's roles. This approach will ensure that a good picture of the many aspects of the SSM is presented.

The Participants

Many organizations play a part in the SSM. They are governmental agencies, Headquarters United States Air Force (HQAF), Headquarters Strategic Air Command (SAC), Numbered Air Forces (NAF), Air Divisions (AD), Bomb Wing Agencies (BMW), and other organizations such as the Air National Guard (ANG), Air Force Reserve (AFRES), and North American Air Defense Command (NORAD). Some provide resources, guidance, and feedback directly to the scheduler's organization, the BMW, while others pass the inputs to organizations above the bomb wings for further allocation. The resources may go through allocation at several levels before being given to the BMW for use. Figures 5 and 6 have been provided in the text to help illustrate the participants and their positions relative to each other.

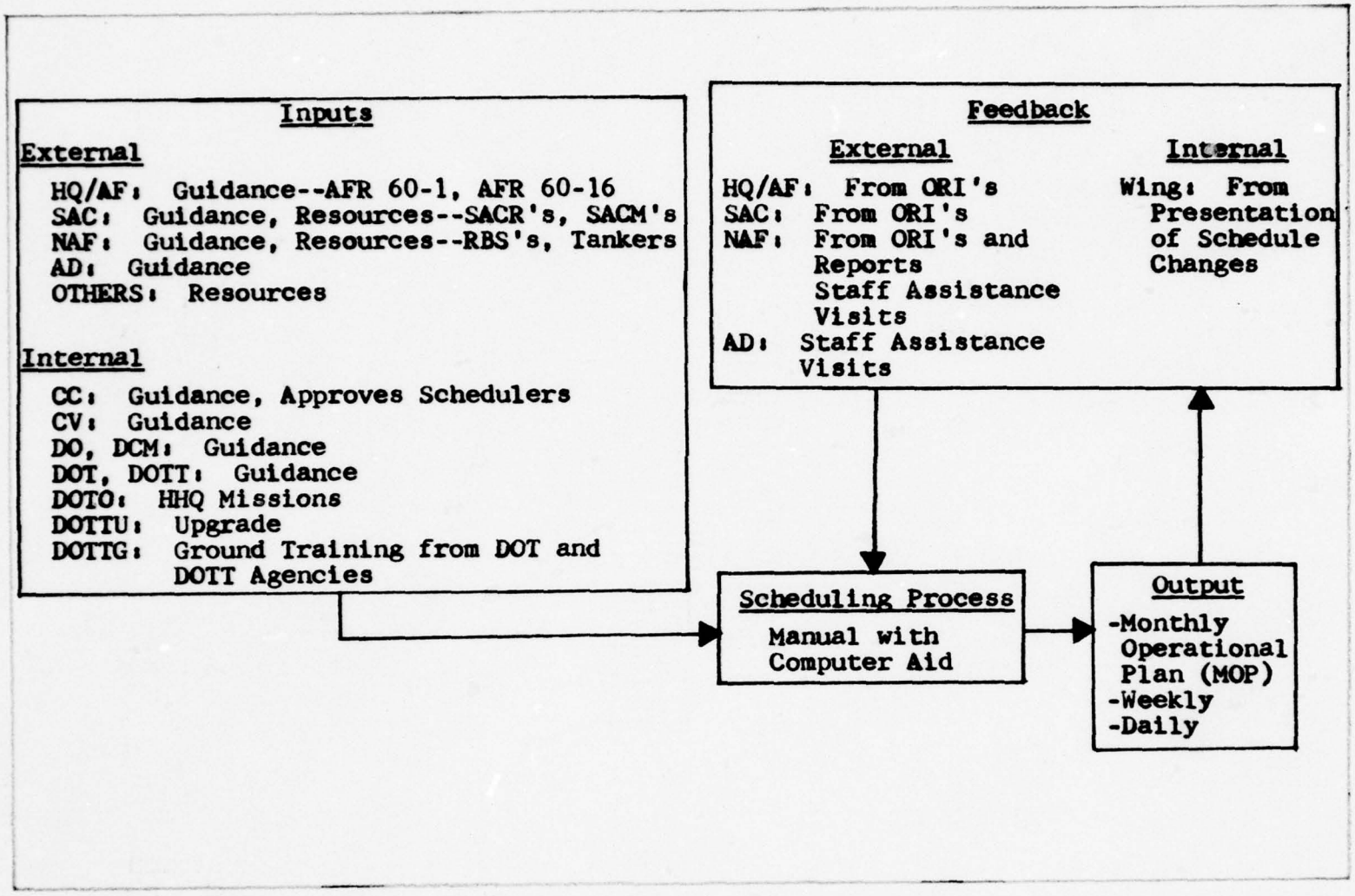


Figure 3. The SAC Scheduling Model (SSM)

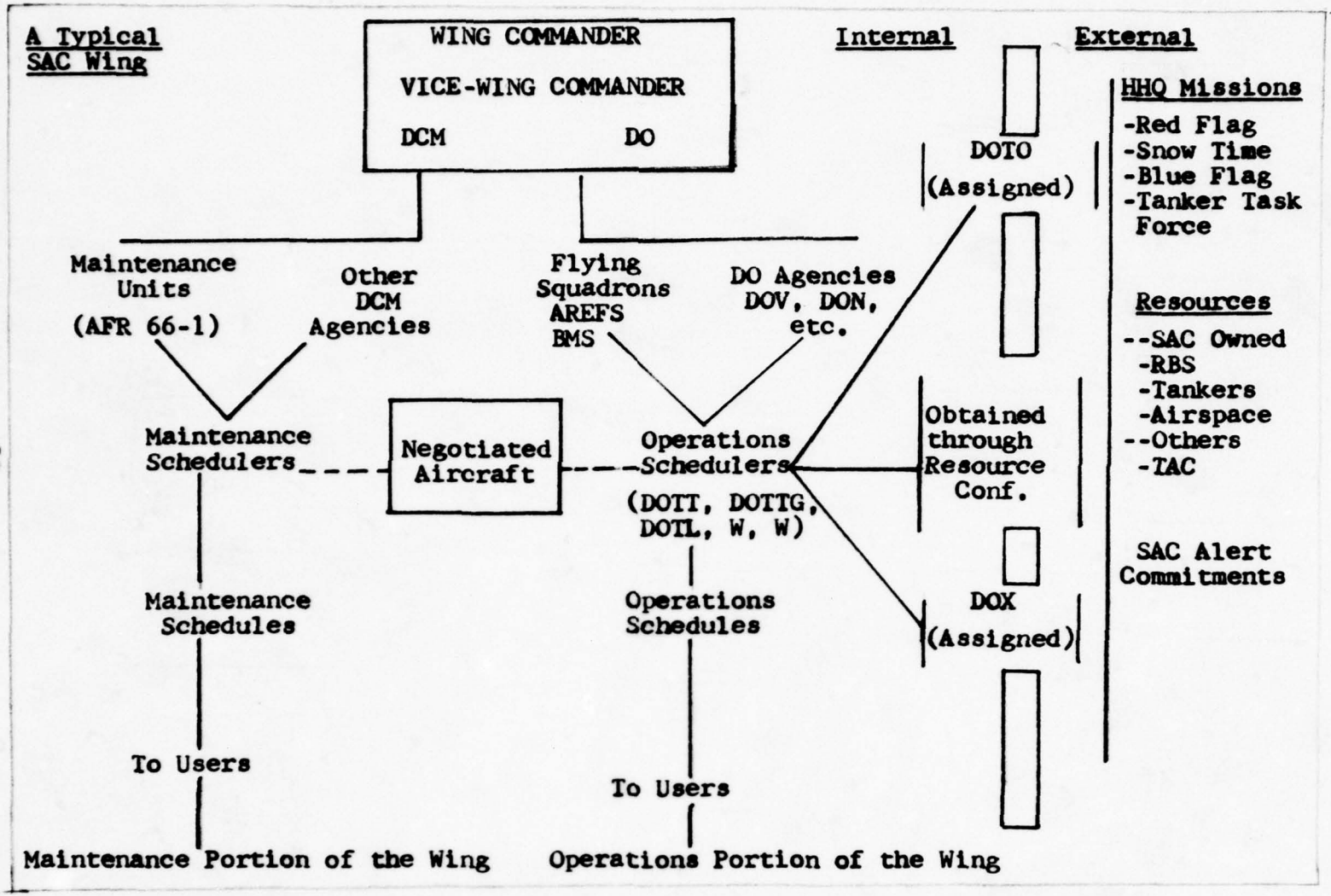


Figure 4. A Typical SAC Wing and the Internal and External Sources of the Scheduling System

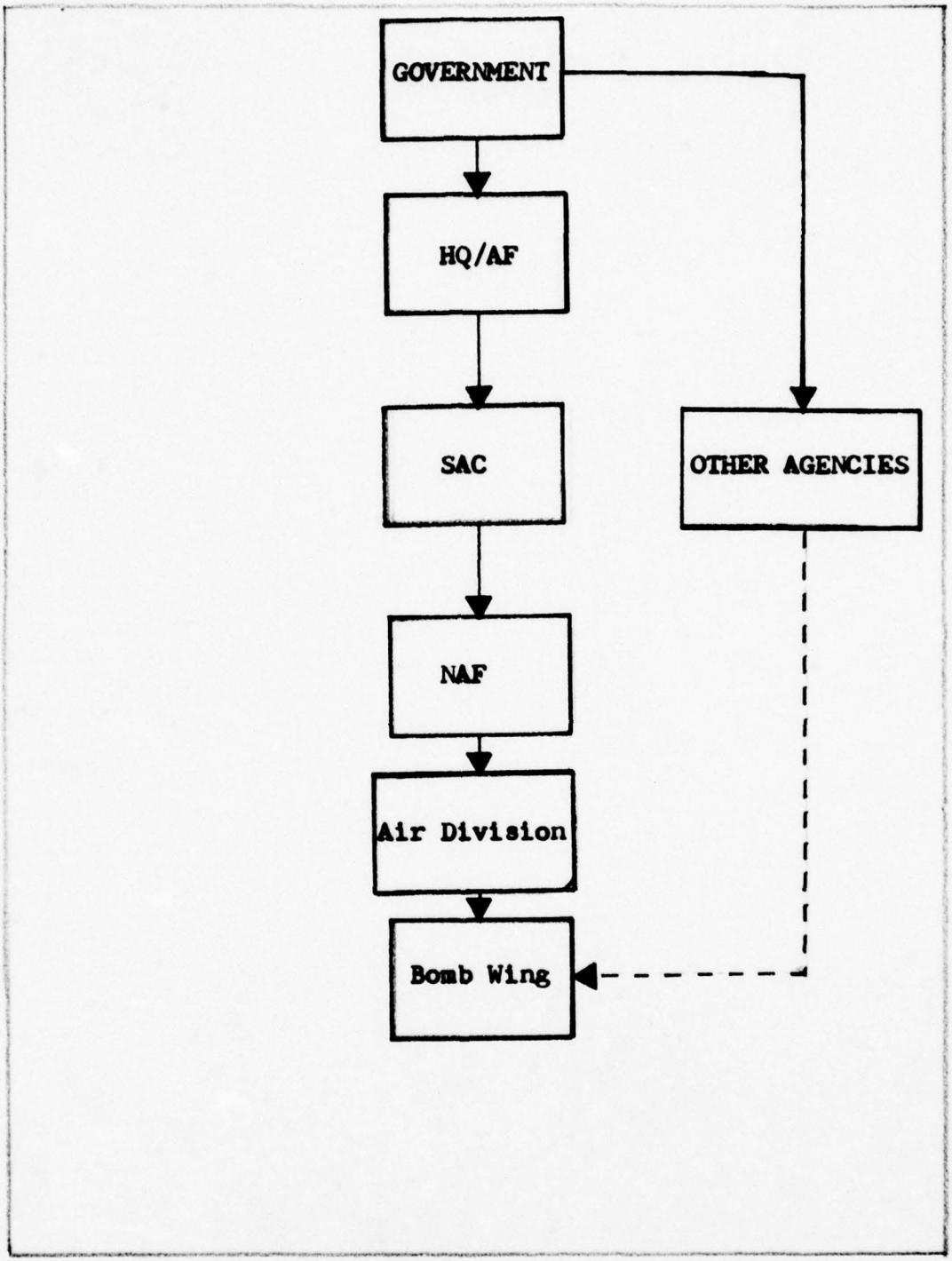


Figure 5. External Participants in the SSM and their Relation to the Bomb Wing

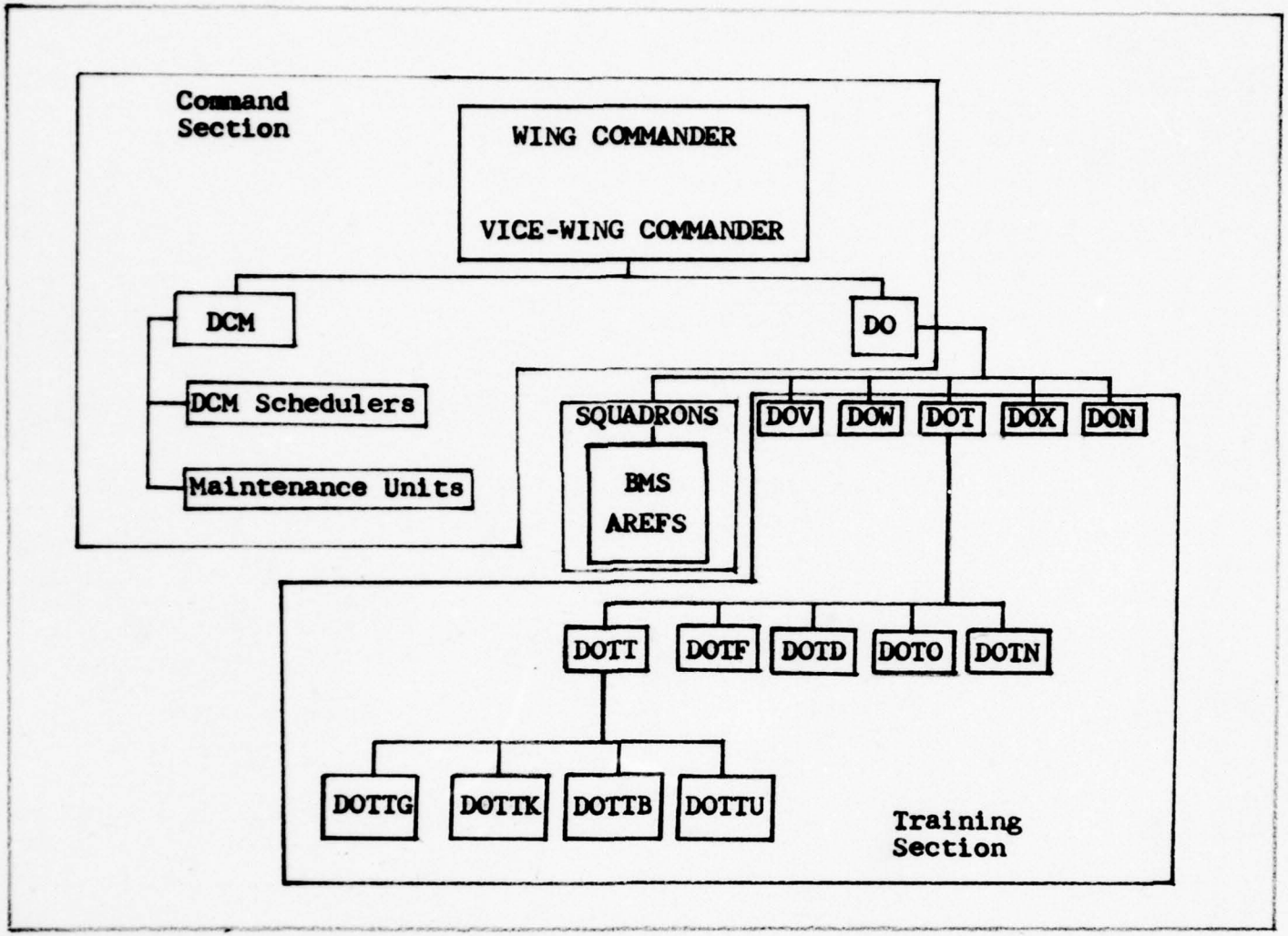


Figure 6. Internal Bomb Wing Participants and their Areas

Government. The government, as explained in Chapter II, is the origin of all the resources and broad mission guidance used by the military organizations. In particular, HQAF receives broad mission guidance, aircraft, personnel, facilities, and money from the governmental agencies. These items are all used by agencies below HQAF. Therefore, the government is an indirect player in the scheduling systems of all the agencies.

Headquarters United States Air Force. HQAF provides guidance, resources, and feedback to various agencies at lower levels (see Figure 5). An explanation of each will show the portions that pertain to the SSM.

Guidance takes many forms and is given to all agencies below HQAF. Broad mission guidance is given to SAC for further definition and allocation to the BMW's. This will later become the alert commitment. Personnel management directives become constraints for the scheduler. AFR 60-1 (Ref 1) and AFR 60-16 (Ref 5) are the ones of primary interest to the SAC scheduler. The first deals with aircrew management, for example, crew rest requirements before flight (Ref 1:7-1), while the second specifies the general flight rules, for example, the requirement to have an instructor pilot on board B-52 aircraft for touch and go landings (Ref 5:5-5). Both publications are supplemented by lower-level organizations to cover particular situations.

Resources are allocated by HQAF to the many lower-level organizations. Money is allocated based on the Major Air Command (MAJCOM) budget. This is eventually allocated to the bomb wings. Personnel are assigned to the agencies based on current and projected manning requirements. In this case, personnel are allocated directly to the BMW's by the Air Force Manpower and Personnel Center (AFMPC). Facilities and aircraft are given to the MAJCOMS as part of the overall operational plan. These resources are eventually assigned to specific wings.

Feedback may be given directly to the wing scheduler (mission developer). HQAF has an operating agency called the Air Force Inspector General (AFIG) that conducts ORI's for the bomb wings. The scheduler's entire operation is examined during the inspection. The AFIG may specify corrective action for problem areas discovered during an inspection. The feedback from this may direct the scheduler to take action to modify the schedule.

Headquarters Strategic Air Command. SAC provides many inputs to the scheduler. These are guidance, resources, and feedback. An explanation of each will serve to show the ones that affect the scheduler.

Guidance from SAC can take many forms. First, SAC can supplement Air Force publications if required to suit some operational need. For example, SAC has supplemented

both AFR 60-1 and AFR 60-16. Next, the broad mission guidance from HQAF is translated into specific sorties to be passed to the bomb wings. Finally, there are many SAC publications that specify the rules for operations. Some examples are SACR 50-9, SACR 50-12, SACR 50-24, and the SACM 51-52 and SACM 51-135 series (see Refs 13-20).

Resources are an important input. First, SAC allocates the facilities to each bomb wing. For the analysis these will be assumed to be previously assigned and present for the scheduler to have a place to work. Then, aircraft are assigned to the bomb wings based on current and projected plans. Finally, SAC gives the budget to the next level, the NAF, for eventual distribution to the bomb wings.

The final input, feedback, may come from the SAC Inspector General (SAC IG) if that agency is the one conducting the ORI. SAC IG acts just like the AFIG in this case, specifying action if needed.

Numbered Air Force. The NAF supplies guidance, resources, and feedback to the bomb wing and to the scheduler. An explanation of each will show the ones relevant to the SSM.

Guidance is usually in the form of supplements to the Air Force and SAC publications. Both 15th Air Force and 8th Air Force have published supplements to AFR 60-16 and SACR 60-4 to cover specific situations. In addition, the

NAF can specify certain additional training requirements, for example, in bombing tactics for B-52 aircrews. 15th Air Force Regulation 50-3 is one such publication accomplishing this task.

Resources are in the form of budgetary allocations, Radar Bomb Scoring Site (RBS) times and ranges, and tanker assignments. The bomb wing budget is formulated by the NAF managers and given to the wing. The scheduler is concerned with the portion designated for aircraft flying time; he receives this each quarter and is expected to use it all. An example of the flying time allocation is shown in Appendix A. RBS times and ranges are allocated by the NAFs; a sample RBS allocation is shown in Appendix A. This is done quarterly at the SAC RBS/Tanker Scheduling Conference. Tanker support is coordinated at this same meeting. It is held at Headquarters SAC, Offutt Air Force Base, Nebraska, for convenience because each wing must deal not only with its parent NAF (8th AF or 15th AF) but also with the other NAF.

Feedback is likewise given to the scheduler and to the wing as in the case of SAC IG and AFIG. The Numbered Air Force Inspector General (NAF IG) is frequently the inspecting agency for SAC wings. In addition, the NAF may give staff assistance visits if there are discrepancies discovered during the ORI.

Air Division. The Air Division provides some guidance and feedback to the bomb wings and to the scheduler. The guidance consists of the Division Commander's management and is usually in the form of requirements. A good example is the requirement for each rated officer in the wing staff to fly at least two sorties each month.

Feedback is provided by many AD staff assistance visits. The AD staff examine each appropriate bomb wing just prior to ORI vulnerability time for compliance with directives and just after an ORI if corrective action is specified by the evaluating agency.

Bomb Wing. The Bomb Wing (BMW) is the source of several players in the SSM. These internal players are at all levels of the wing. They will be addressed in three broad areas called command, training, and squadrons. Figure 6 shows the agencies and their relative positions.

The first section is the command area. This includes the wing commander (CC), the vice wing commander (CV), the director of operations (DO), and the deputy commander for maintenance (DCM). An explanation of each will show the particular contributions to the schedule.

The CC is responsible for the entire wing operation. He oversees this and applies his management philosophy and guidance to all the wing agencies, particularly the scheduling office. In addition, he approves the schedules (Ref 13:3-1).

The CV works closely with the CC. He adds his own philosophy and guidance and acts for the CC when necessary, for example, while the CC is not on station.

The DO is responsible for the operational aspects of the wing, areas such as flight operations and scheduling. He provides his own management philosophy and guidance to this area. In addition, he provides several very important inputs to the schedule. These are the quarterly planning factors, information that is coordinated with the DCM to establish the available number of sorties for any particular quarter. These planning factors consist of the total number of sorties programmed by type, for example, continuation training or higher headquarters, total number of flying hours programmed, forecast number of crews available for training, and the aircraft/aircrew alert requirements. The DO also submits the schedule to the CC for approval (Ref 13:3-1). In actual practice these items are prepared by the scheduler, approved by the DO, and forwarded to the DCM or the CC as applicable.

The DCM manages the wing maintenance effort. The main DCM inputs to the scheduler are the aircraft for use on flight missions and aircraft for the alert requirements. These are coordinated with scheduling by the DCM schedulers.

As an addition to the command area, it must be noted that all players provide some type of feedback to the scheduler. This may be only a signature to the scheduler if the

product is acceptable. However, if the schedule presented is not feasible, the feedback may take the form of directions to make the necessary changes to fix the discrepancy.

The second area is called the training area. This includes the DO agencies and their respective subordinate offices, the ones that provide some input for the schedule. The following explanation will serve to illustrate their roles.

The first agency is the chief, training division (DOT). This man is responsible to the DO for all aspects of the wing training effort. The schedule and maintenance of training records are but two of his many responsibilities (Ref 38:2-1). These and other functions are managed by the DOT agencies.

The second agency, mission development (also called DOTT or scheduling), is responsible to the DOT for the preparation of all schedules. These include the Monthly Operations Plan (MOP), a plan specifying three months of proposed activity (Ref 13:3-1), and the resulting weekly and daily aircrew activities schedules (Ref 38:3-1). DOTT is the focal point for the SAC scheduling effort. There are four separate portions of DOTT to accomplish the tasks. Wing Upgrade (DOTTU) manages the qualification training for new crewmembers. Ground Training (DOTTG) handles all ground training items and ensures that they are properly integrated into the schedule. Bomber scheduling (DOTTB) and

tanker scheduling (DOTTK) take information from DOTTU and DOTTG and use them as part of the considerations for the schedules. This thesis will deal only with the DOTTB actions, realizing that DOTTK does the appropriate tasks for tanker aircrews. In addition, DOTT tracks flying time and training accomplishments for the DOT.

Other DO and DOT agencies provide information to DOTT agencies for inclusion in the schedule. The command post (DOC) provides ground training concerning Command and Control Procedures (CCP), an important item for the SAC wartime mission. Bombardment navigation (DON) provides inputs concerning navigation, for example, the preferred lineup (the "Gunfighter Lineup" in Appendix B) for alert crews during periods of ORI vulnerability. Standardization/Evaluation (DOV) provides the evaluation requirements for aircrew personnel and specifies corrective action in case of failures during the evaluations (Ref 20:3-5). A sample input for required evaluations is shown in Appendix B. Operations Plans (DOX) provides the alert commitment and training to keep the aircrews current in the wartime mission procedures. Current Operations (DOTO) provides data concerning higher headquarters missions and the ORI mission to the scheduler. It is to be noted that the higher headquarters missions can originate in every external agency mentioned as well as those designated as other agencies. Flight records (DOTF) provides the computerized documentation of training

accomplishments. Life Support (DOTL) provides inputs concerning required training in the various areas of survival. Air weapons (DOTW) specifies the required training for aircrews in the weapons used by the B-52 aircraft. Training Devices (DOTD) provides inputs concerning synthetic training system requirements, for example, the T-10 navigation simulator for navigators. Finally, the defensive systems branch (DOTP) provides inputs concerning special training for electronics warfare officers and gunners, for example, briefings on current and projected B-52 defensive equipment.

The final bomb wing area is the squadron, the agency that manages the aircrew personnel. This organization furnishes pertinent data such as the leave schedule, temporary duty periods (TDY), crew compositions, and crew changes. Sample leave schedules and crew changes are shown in Appendix B. The scheduler depends on these inputs to determine personnel availability for training.

Other Agencies. This term is used to denote all agencies not previously mentioned that give inputs to the scheduler's organization. Some examples are the Air National Guard (ANG) and Air Force Reserve (AFRES) units that provide both tanker and fighter support to the SAC bomb wings for training. In addition, agencies such as Red Flag use the SAC bomber and tanker resources as a part of their operation. These particular taskings are passed to DOTO for processing

and are eventually given to DOTT. Finally, agencies of North American Air Defense Command (NORAD) and Air Defense Command (ADCOM) allocate fighter aircraft and airspace for training purposes.

Explanation of the SAC Scheduling Model

Now that the players have been introduced, the next task will be to explain the SSM and show the various parts--the inputs, the scheduling process, the output, and the feedback. This will be accomplished in the order specified. Important assumptions will be introduced as appropriate in the text.

Inputs. To begin the scheduling process the scheduler must have inputs, the first part of the SSM. These come from both internal and external sources. Throughout the explanation it will be assumed that each input comes from the lowest applicable level, the one that actually provides the input to the bomb wing. In addition, it is assumed that the facilities have been allocated and the bomb wing is in full operation.

Externally the parent organizations (HQAF, SAC, NAF, and AD) and the other organizations (ANG, AFRES, and NORAD) supply guidance and resources for the scheduler to use as he formulates the various schedules. Each input of the SSM will now be addressed.

HQAF supplies guidance in the form of AFR 60-1 and AFR 60-16. The first publication specifies the rules and constraints for aircrew management (Ref 1:i) while the second specifies the flying rules for operating Air Force aircraft (Ref 5:i). These are definite constraints for the scheduler. In addition, SAC and the NAFs have supplemented these Air Force Regulations to cover some specific operational situations. The scheduler must follow the guidance in these publications as he formulates the various schedules.

SAC supplies guidance to cover all aspects of the SSM. SACR 50-9 (Ref 13) provides detailed guidance for the development of the various schedules, in particular, the Monthly Operations Plan (MOP), the weekly schedule, and the daily schedule. In addition, SACR 50-9 specifies planning policies such as the scheduling of ground training items during periods of alert duty and keeping an equitable distribution of alert duty among the allotted crews. SACR 60-4 (Ref 20) specifies the detailed evaluation requirements for crewmembers and requires that the alert duty for the Standardization/Evaluation crews be less than that for the line crews. These are important considerations for the scheduler. SACM 51-52 (Ref 16) specifies the training program for the bomber crews. The entire scheduling effort is directed toward the completion of all required items by the

assigned personnel. SACR 50-12 (Ref 14) specifies the mission planning requirements for the aircrews. For example, each crew must be given a full day to mission plan prior to flight (Ref 14:11-1). Finally, SACR 50-24 (Ref 15) specifies the ground training requirements for aircrews. These are handled by DOTTG, who passes the information to the DOTTB. These activities must be properly integrated into the schedule. It is evident that SAC guidance is extensive. Each portion will be further explained as the actual scheduling process is discussed later in this chapter.

NAF and AD guidance consists of supplements to the Air Force and SAC publications as well as policy guidance. The first usually comes from the NAF while the second comes from the division commander. Again, the supplements cover special conditions. The example presented in the players section is typical of the AD input. Each area is a definite consideration for the scheduler.

External resources are both allocated to the scheduler's organization and negotiated by the scheduler for use. These are tankers, RBS times and ranges, fighter resources with the applicable working airspace, and flying time authorization.

All these resources are arranged by calendar quarter, i.e., January-March, April-June, July-September, and October-December, based on projected usage requirements. The tankers and RBS commitments are coordinated with the

NAFs (8th AF or 15th AF) at the Quarterly RBS/Tanker Scheduling Conference, normally held around 45 days prior to the start of the quarter. Indications are that this will move to 75 days before the start of the quarter. ANG and AFRES units also attend and coordinate their refueling activities as part of this conference. Fighters are coordinated directly with the appropriate fighter squadron; the airspace is coordinated with the controlling agency, usually a NORAD Air Division. This is done about 30 days before the beginning of the quarter. At present, there are no indications of movements to this timetable. Finally, the flying time authorizations are given to the DOTT by the parent NAF managers. Projections are available up to 75 days before the quarter, but the precise figures are not distributed until about four weeks before the calendar quarter begins.

Internally, guidance and resources are provided to the scheduler from the appropriate levels of the wing. The following text will explain the pertinent ones.

Guidance is available from the CC, CV, DO, and DCM. In these cases, the guidance is usually management guidance. As part of their respective jobs, these people oversee their areas of operation and provide guidance when necessary. As previously mentioned, the CC approves the schedule; the CV will do this if the CC is absent. In addition, the DO and DCM interact to agree on the available aircraft before the DO submits the schedule to the CC or CV.

The DOT and DOTT provide more guidance. Again, this is a part of their respective jobs. However, the scheduler works more closely with these individuals, so the guidance is always present during the formulation of the various schedules.

The DO and DOT agencies mentioned in the players section provide their inputs for inclusion in the schedules. Some examples are the DON "Gunfighter Lineup" and the DOV list of required evaluations. Also, DOTP and DON may submit requests for certain crewmembers to receive additional training if substandard performance is indicated. The other agencies will submit their requests for continuation training; these must be included in the schedules.

Resources are allocated by the LGM, DOTT, and squadrons. Each is very important to the scheduler. The LGM supplies the aircraft based on the DO's quarterly planning factors. This is formalized each month by a document called the Sortie Contract, showing the number of aircraft required each day and the type of mission (see Appendix B). The DOTT specifies the number of flying hours available and the allowable number in excess of this to allocate to allow for lost flying time. The squadrons supply personnel to be trained. This includes the crew composition and changes, projected leave schedules, TDY's, and those unavailable to perform flying duties due to medical reasons (DNIF's).

The Scheduling Process. Now that the inputs have been explained, the next task is to assemble them to form the schedules for operations. The B-52 scheduler formulates three types, the MOP, the weekly schedule, and the daily schedule. The guidance in SACR 50-9 is used to ensure that all pertinent areas are included. Each type of schedule will be developed in turn. The months of October, November, and December 1976 will serve as the examples during the explanation.

The MOP is a comprehensive schedule of three months (not necessarily calendar quarters) of BMW activity, a timetable compiled using the best available information. The mission developer makes three types of schedules to complete the MOP. These are the working schedule, the semi-final schedule, and the final schedule (Ref 13:3-2). The explanation will cover the development of these schedules. It will begin with certain preliminary actions and proceed through a detailed explanation of the process used to develop each schedule.

Before the scheduler can start the MOP, he must accomplish several tasks. They come in a particular time sequence; each will be explained in this order.

Around 60 days prior to the start of a calendar quarter the NAF will send the proposed flying time and RBS allocation to the wing. The scheduler will take this information and formulate the proposed number of sorties

needed. He will further take the projected sortie allocation by day and determine the required times and places for aerial refueling support.

About 45 days prior to the start of the quarter the scheduler attends the SAC RBS/Tanker Scheduling Conference. There he coordinates the RBS and tanker times and airspace requirements for the upcoming quarter. These are firm commitments, items he can use to plan wing flying operations.

Around 30 days prior to the start of the quarter, the firm flying hour allocation is specified. The scheduler makes adjustments as necessary and proceeds to the next task.

In this same time frame, the mission developer determines the fighter requirements for his projected training. He coordinates these directly with the applicable units. The fighter squadrons are usually chosen close to the scheduler's base to minimize the flying time required to get to the working area. The specific areas are coordinated with both the fighter unit and the NORAD Division.

By two weeks before the start of the quarter, the scheduler has developed the Quarterly Planning Factors for the DO to present to the DCM. These include the total sorties programmed by type, the flying hours programmed, the forecast number of crews available, and the alert requirements. The information required to do this is obtained from the appropriate agency and compiled.

With this, the mission developer can start to develop another document, the "Sortie Contract" (see Appendix B). This is a detailed listing of required sorties for the upcoming month, specified by type, takeoff time, and approximate duration. This is signed by both the DO and DCM at the Monthly Operations Meeting usually held near the 19th of the month prior to the flights. With this, the preliminary planning is done and the three types of schedules for the MOP can be developed.

The working schedule (see Appendix C) reflects the best known information for the third month for the MOP. In this instance, December 1976 is the month of concern. To develop this schedule, the scheduler need only take the leave schedule (from the squadron), known TDY's (from the squadron), and any known higher headquarters commitments (from DOTO) and transpose them to the SAC Form 681. At this point, the working schedule is complete.

The second month of the MOP is the semifinal schedule. This is simply a working schedule with refined information and specified additional information. First the scheduler makes changes to the information contained in the working schedule, if necessary. He adds any other known higher headquarters commitments. In addition he adds the proposed alert schedule. In times of ORI vulnerability, he may be constrained by guidance such as the "Gunfighter Lineup." Otherwise, alert assignments are arbitrary. The scheduler

is directed by SACR 50-9 to equalize the distribution of alert duty (Ref 13:2-1), with the additional constraints specified in SACR 60-4, Volume I, to limit the alert requirements for standardization (Stan/Eval) crews to 70 percent of that required for other crews and further limit it to 60 percent for the senior Stan/Eval crew (Ref 20:1-4). The semifinal schedule for November, 1976, is shown in Appendix C.

The first month of the MOP is the final schedule. It is a refinement of the semifinal schedule for the particular month and includes all known activity for the bomb wing flying personnel. Here, the scheduler takes all known inputs and assembles them to form a comprehensive plan for operations (Ref 13:3-2).

The sequence for development of the final schedule is entirely arbitrary, that is, none is specified. A typical approach will be used to illustrate the process.

First the scheduler updates the information contained in the semifinal schedule from the previous month's MOP. He takes the current leave schedule, the firm alert schedule (considering the constraints), and the updated TDY schedule and posts them to the SAC Form 681 (681) for the upcoming month. Then he adds the updated higher headquarters commitments as obtained from DOTO. Next he takes the projected ground training requirements from all agencies. This information is obtained from DOTTG. The requirements that cannot be accomplished during an alert tour are posted

to the 681 (Ref 13:3-2). The DOTTU inputs, both flying and ground training, are also taken and posted for the applicable crewmembers. The mission developer is now ready to add the flying schedule.

The method for allocation of the flying sorties is also arbitrary within certain limitations. First, the scheduler is constrained by the current wing management philosophy for training priorities. The usual priority is HHQ missions, SACM 51-52 training, SACR 60-4 evaluations, upgrade flying requirements, directed training, and ground training (Ref 38:7). If some tradeoffs must be made, this priority will be used to determine the activity to be scheduled. In other words, the item with the highest priority will take precedence. Second, the crew must be given a day for mission planning if it is not possible to do this on alert. Third, if an evaluation is planned, an evaluator must be scheduled for the flight. As a result, the schedule for the Stan/Eval crews (S-01 to S-04 in this example) will be affected. Next, the scheduler must follow the sortie contract. Finally, the flights must be programmed so that a minimum of 12 hours of crew rest is available for all concerned crew members (Ref 1:7-1). For example, a crew member could not legally fly a night sortie and fly a day sortie the next day. Using these guidelines the scheduler adds the missions to the 681's in accordance with the sortie contract. Additionally, the scheduler also fills out 681's for each

crew, showing the particular type of activity scheduled for each crew member by day. With this the final schedule is completed. Samples of the 681's for October, 1976, are shown in Appendix C.

The MOP is now completed. It is signed by the DO, presented to the CC for approval, and distributed by the 25th day of the month prior to the flights (Ref 13:3-1). The Monthly Operations Plan is now a directive for wing operations for the applicable month of the final schedule. It is to be realized that this process takes place every month for the three schedules and the sortie contract.

The next types of schedules, the weekly and daily, are derived from the final schedule for the applicable month (Ref 13:3-3). The weekly schedule covers operations from Monday to Sunday (Ref 13:3-4) and is simply a collection of the respective daily schedules. The following text will cover the development of these schedules as accomplished at a bomb wing. As with the MOP, the method is arbitrary. The one presented is one possible way to develop the schedules.

The mission developer begins this task about ten days prior to the first flight of the applicable week, usually a Wednesday or a Thursday. First the scheduler consults the final schedule for the month to see which crews are scheduled to fly during the week. Then he consults the sortie contract, the tanker allocation, RBS allocation, and fighter resources (if applicable) to determine the approximate

takeoff times and resources available. The tanker and fighter resources are reconfirmed with the applicable units at this time. Next, he consults the DOTT who specifies the allowable number of flying hours to schedule for the week. In practice the scheduler is allowed to overschedule by eight percent to allow for flying time losses. Then, he consults the computer listing of training accomplishments to see if there are any particular training items such as a special type of bomb run (Ref 16:6-3) that would dictate special consideration for the type of mission. Finally, he checks any unofficial records, such as one specifying the particular RBS sites used by each crew, to help decide where to send each crew.

Guidance is present to help the scheduler. SACR 50-9 specifies broad guidance, such as the requirement to have an effective alternate mission for each one programmed and the general processing procedure for the weekly and daily schedules (Ref 13:3-3).

The scheduler then assembles the inputs to form specific missions using the SAC Form 364a (364). The method is manual, time consuming, and aided only by a computer print-out of training accomplishments. A sample 364 is shown in Figure 7.

On Friday afternoon or Monday morning the scheduler calls the maintenance scheduler and relays the appropriate

ACFT NO	ACFT CMDR	SCH TO	DUR	TYPE SORTIE	JP-4	CODE	SRAM	CHAFF	GUN	TA	CAM	ALAT	MSN NO
CALL SIGN	CREW NO		DWN TME		TKR	AREA		ARCT	A/R TME	ON LD	ALT	RDZ	PEID
0008	Saunders	1100	9+30	EPTS	240M	24	YES	TA-8	DCE/ EPE	YES	0-32	1830	104
10	R-14		2030		906/ 54	AR-12W		1810	:35	10M	300	PT/ PAR	A
P-60-4-1 IP-Hagemann CP-60-4-1 SUB-RN-Moore					NAV LEG AFTER A/R PRIMARY ENTRY OB-24 2059 BISMARK 2145,2215 FIE RED RIVER SOUTH 2315-0015								

Figure 7. Sample SAC Form 364a

data such as the takeoff time, fuel load, and planned landing time. The maintenance scheduler will assign specific aircraft to the mission and coordinate them with DOTTB on Monday or early Tuesday. The schedule is now ready for review by the wing staff.

The first staff review occurs at the Pre 60-9 meeting, usually held on Tuesday afternoon. The meeting is attended by the DO, DOT, DOTT, DON, and representatives from the squadron, DOTP, DOV, and the maintenance schedulers (Ref 13: 3-3, 3-4). The mission developer presents the proposed schedule and the participants indicate changes needed to resolve any possible conflicts.

After changes, the schedule is ready for the 60-9 meeting, usually held on Wednesday afternoon. This is attended by the CC (or CV) and DCM, as well as those who attended the Pre 60-9 meeting. Again, the schedule is presented and changes are suggested if needed. The DO and CC (or CV) sign the cover sheet, indicating approval, and the weekly (and daily) schedule is a directive for wing operations for the upcoming week (Ref 13:3-4). A sample of the output for a single day is shown in Figure 7.

The mission developer makes any needed changes and takes action to publish the schedule. After printing, the DOTTB distributes the weekly schedules to all concerned agencies by 1700 on Thursday (Ref 13:3-3). With this, the scheduling process is complete.

Output. The results of the scheduling process, the outputs, have been explained in the previous section and demonstrated with figures showing typical products. To reiterate, the SAC scheduler develops the Monthly Operations Plan and weekly schedules which are composed of daily schedules.

Feedback. The final part of the SSM is feedback, an important input for the scheduler. This input normally results from the planning and execution phases of the various schedules. The following text will serve to explain these sources of feedback and their impact on the scheduler.

The mission developer receives feedback from the staff personnel (CC, CV, DO, DCM, DOT, etc.) during the planning stages. This is received at the Pre 60-9 meeting and the 60-9 meeting. The staff usually finds infeasible areas and suggests changes. In this case, the scheduler incorporates these items into the proposed plans. The CC approves the schedule at the 60-9 meeting and the scheduler takes action to publish and distribute the schedule. Then, the feedback received during the planning is received at predictable times and in a predictable form. The scheduler handles this in the normal conduct of planning duties.

The feedback received during the execution of the schedule and as a result of the execution of the various plans is normally received at unpredictable times and in many forms.

An explanation of the mission developer's actions while putting the schedule into effect will serve to illustrate the many areas that generate feedback and the type of feedback that can be expected.

The day prior to mission planning, the scheduler does several things. First, he consults the schedule to see which crewmembers are to fly on the specific day. Then he consults the computer record of training to see which items the applicable crewmembers need to accomplish in order to progress toward completion of the SACM 51-52 and other directed training requirements. Finally, he transposes the proposed activities to a Mission Accomplishment Report (MAR) for each crewmember and assembles them to form a package for the flight crew. The record of training and MAR are computer forms and unavailable due to privacy act constraints. The actual training items are specified in SACM 51-52, Volume IV, as shown in Appendix D.

The DOTTB now accomplishes any other duties and waits for feedback. This can come at any time from mission planning to final landing. For example, the crew may discover some flaw in the MAR or schedule of events. The weather conditions or maintenance factors may preclude an on-time takeoff or accomplishment of the scheduled activity. Items of this nature will force the scheduler to reaccomplish portions of the plan on very short notice. In the case of night activities, this may occur at 0300 hours. For inflight

aircraft he must obtain DO approval for any changes. If an RBS time change is necessary he must obtain approval from the appropriate NAF (Ref 13:3-4). These are but a few of the possible things that can take place during the execution phase.

The day after the mission, the scheduler attends the Mission Review Meeting (MRM) to ensure that all pertinent data is recorded and validated (Ref 14:11-5). He will take this information and use it to reschedule training items if necessary.

In addition, feedback can come from the various IG organizations during ORI's and the many agencies such as the NAF and AD who conduct the staff assistance visits. If any problem areas are encountered, the DOTTB is directed to take action to correct the discrepancies.

Summary

The SSM, a GEMS Military Application, has been shown to have inputs, a scheduling process, an output, and feedback. All areas appropriate to the scheduling problem have been identified and explained. The same type of information for the 552 AWACW is contained in the next chapter.

V. The AWACS Scheduling Model

In this chapter the writers will explain the **AWACS** Scheduling Model (ASM) as shown in Figures 8, 9, and 10. First, the participants in the ASM and the applicable resources will be explained. The discussion will specify them as either external or internal to the AWACW. Then the ASM will be explained in detail while showing how the participants and resources interact.

External Participants

The external participants are those that are outside the scheduler's own organization. The ones applicable to the ASM are the governmental agencies, Headquarters United States Air Force (HQAF), Headquarters Tactical Command (TAC), Numbered Air Force (NAF), and other organizations. The input flow is similar to the SSM. Figure 11 shows the positions of these agencies relative to the AWACW. Each external participant will now be described in turn.

Government. The governmental agencies and their inputs were discussed in Chapter IV. They play the same role in the ASM as the one specified for the SSM. Again, the government is an indirect player.

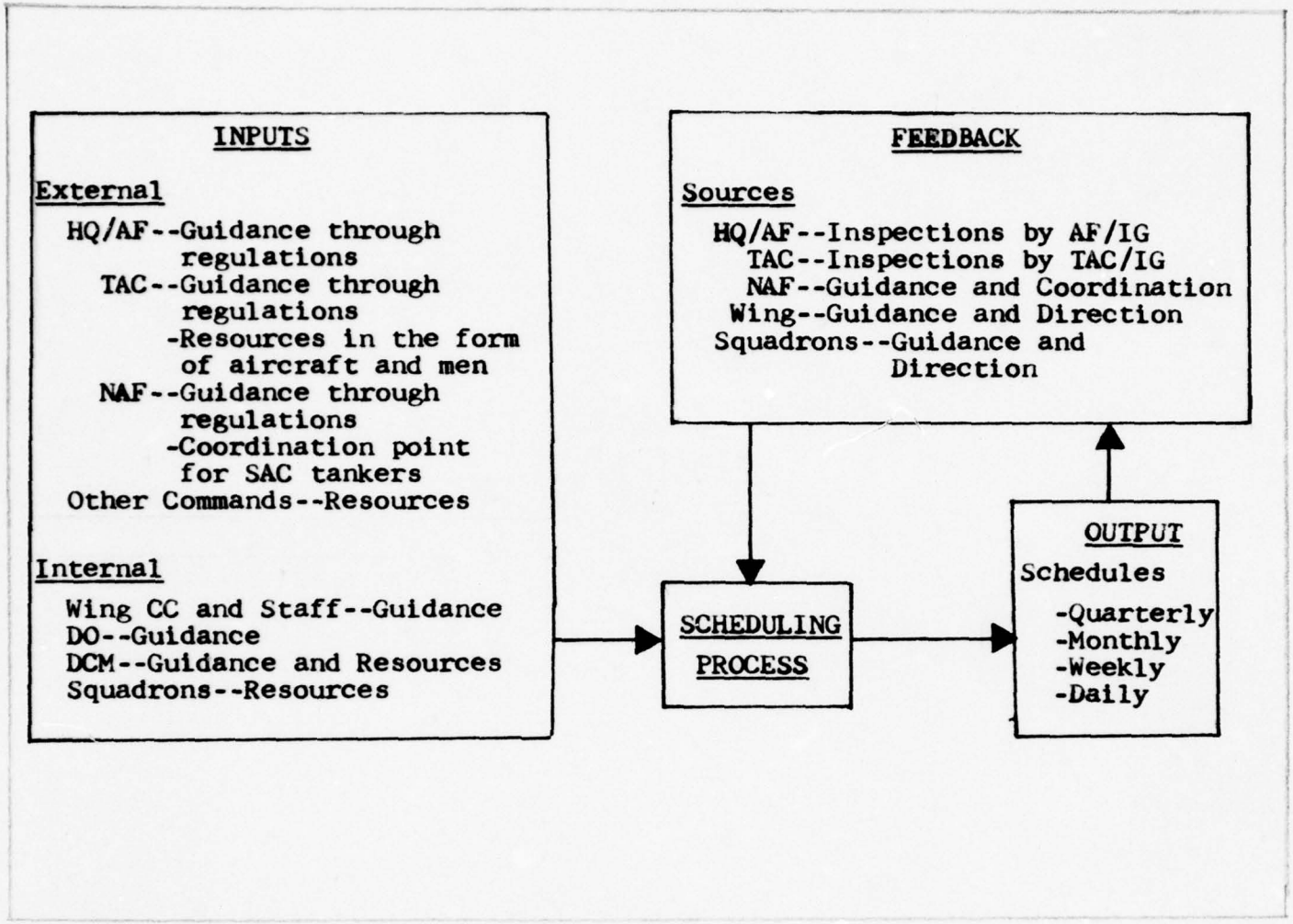


Figure 8. The AWACW Scheduling Model (Wing Level)

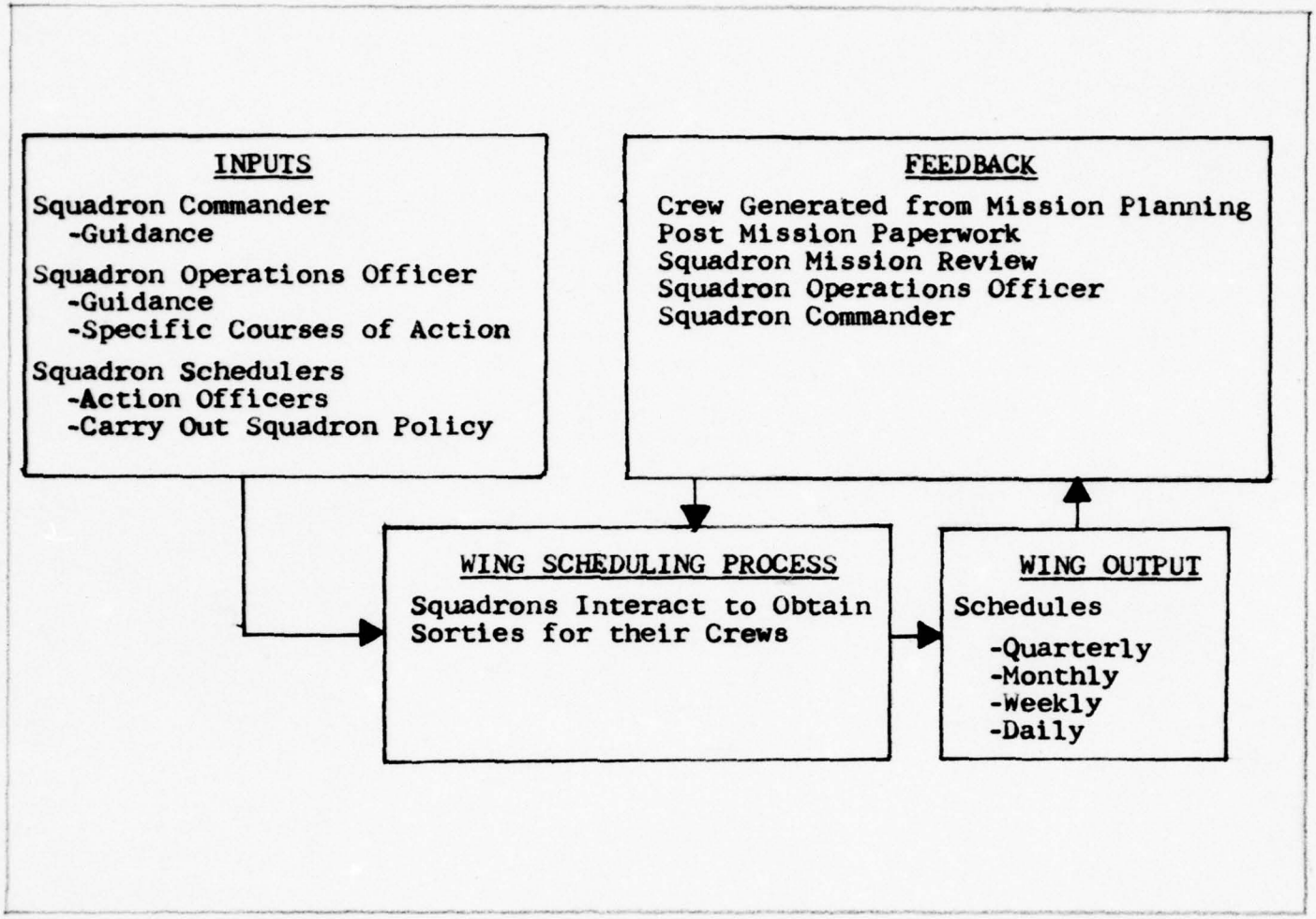


Figure 9. The AWACW Scheduling Model (Squadron Level)

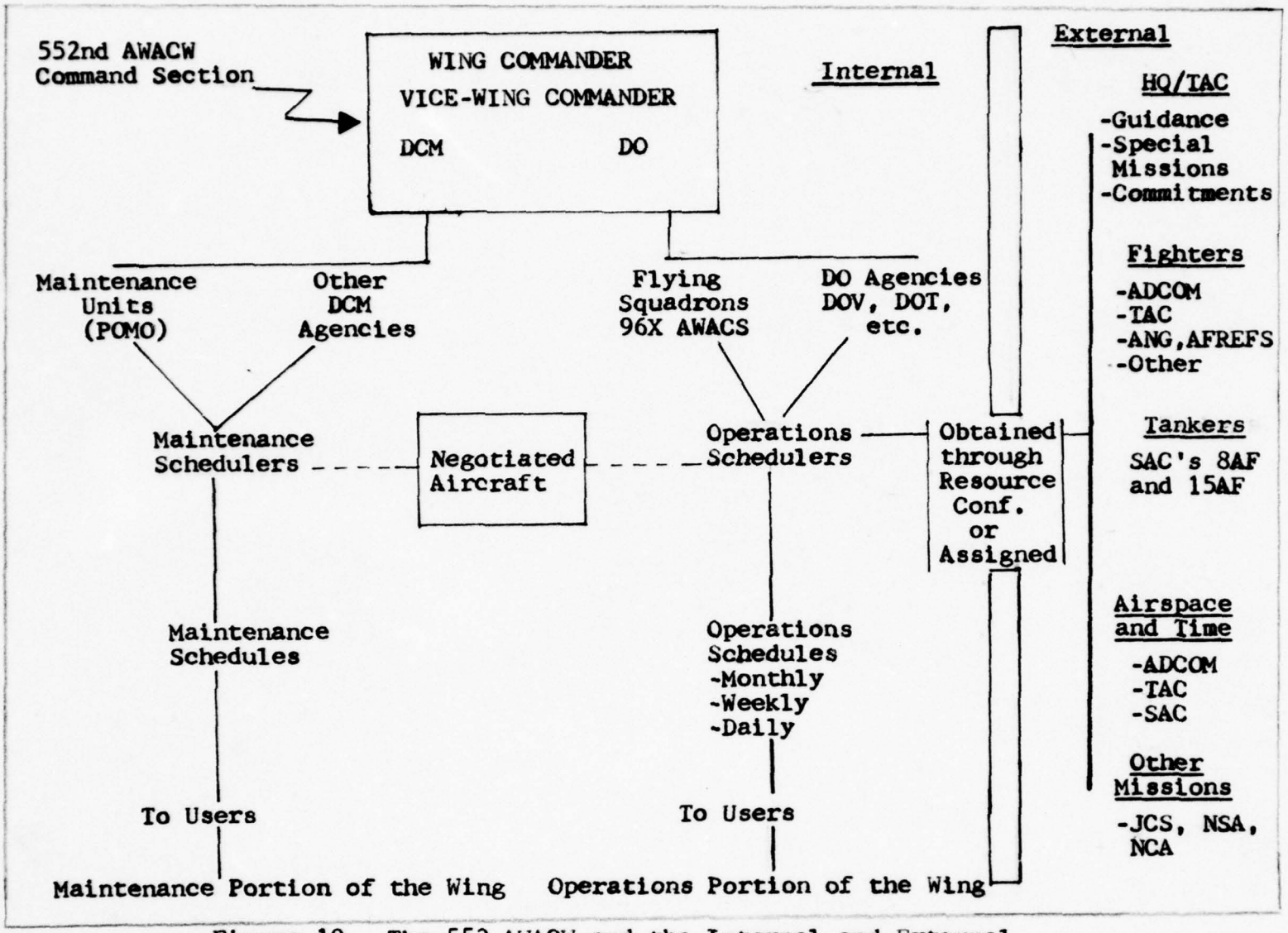


Figure 10. The 552 AWACW and the Internal and External Sources of ASM

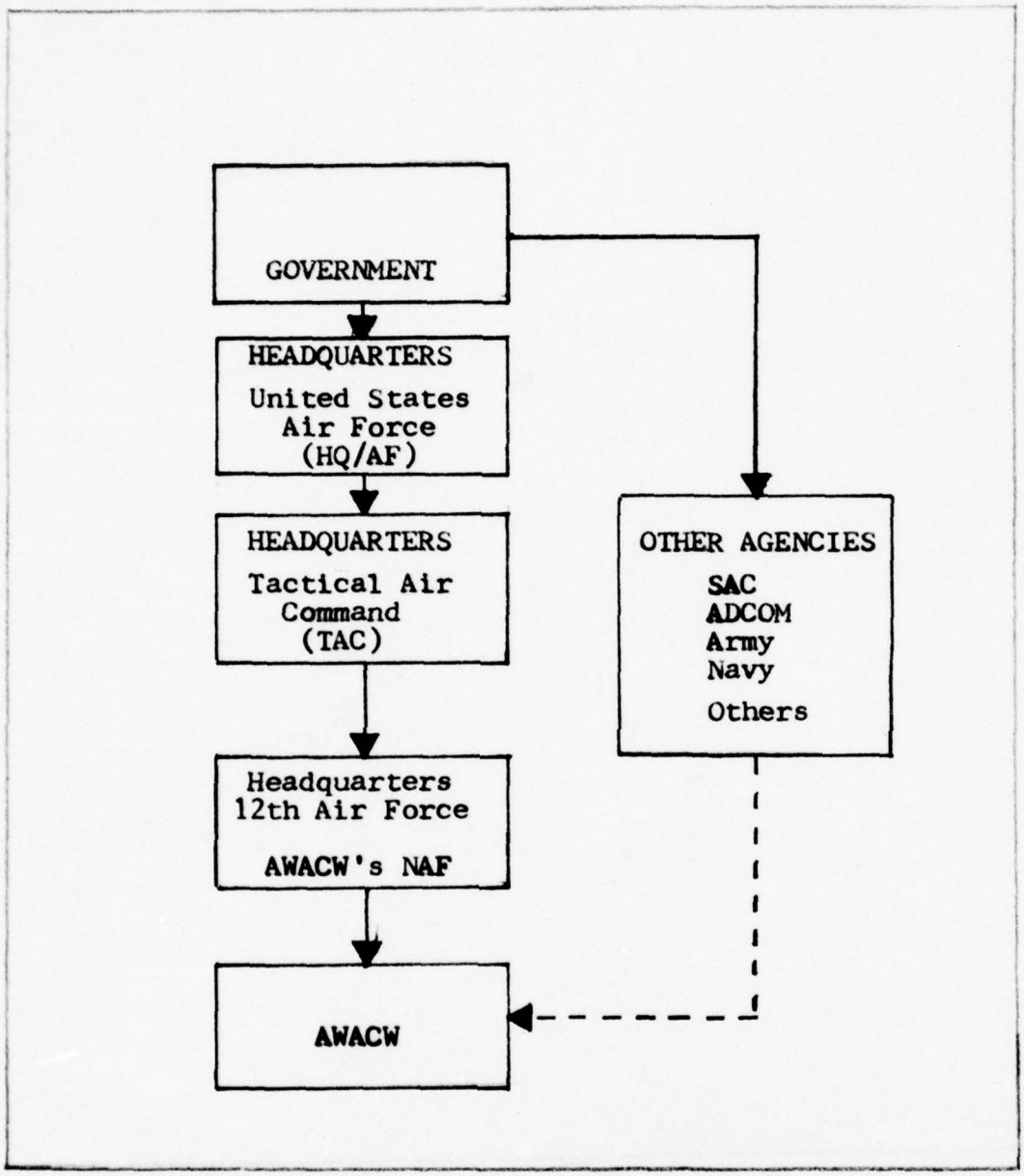


Figure 11. External Participants in the ASM and Their Relation to the AWACW

Headquarters United States Air Force. HQAF supplies guidance, resources, and feedback to agencies at lower levels (see Figure 12). The flow affecting the ASM is quite similar to that in the SSM.

The broad mission guidelines are further refined and given to TAC for more definition and distribution to the AWACW. Personnel management directives provide constraints for the scheduler. As in the SSM, AFR 60-1 and AFR 60-16 are the regulations of primary interest to the scheduler.

Resources are allocated by HQAF to the many lower level organizations. Money is allocated to TAC for E-3A operations; this is later distributed directly to the 552 AWACW. Personnel and aircraft are given to TAC for further allocation.

Feedback from the AFIG can also enter the picture if the evaluation is conducted by that agency. Again, the scheduler may be directed to take action to correct a discrepancy.

Headquarters Tactical Air Command. TAC provides many inputs to the scheduler. These are guidance, resources, and feedback. An explanation of each will serve to show the ones that affect the scheduler.

First, the broad mission guidance is turned into specific requirements by the TAC Directorate of Operations for Command and Control (DOA). These are passed to the AWACW

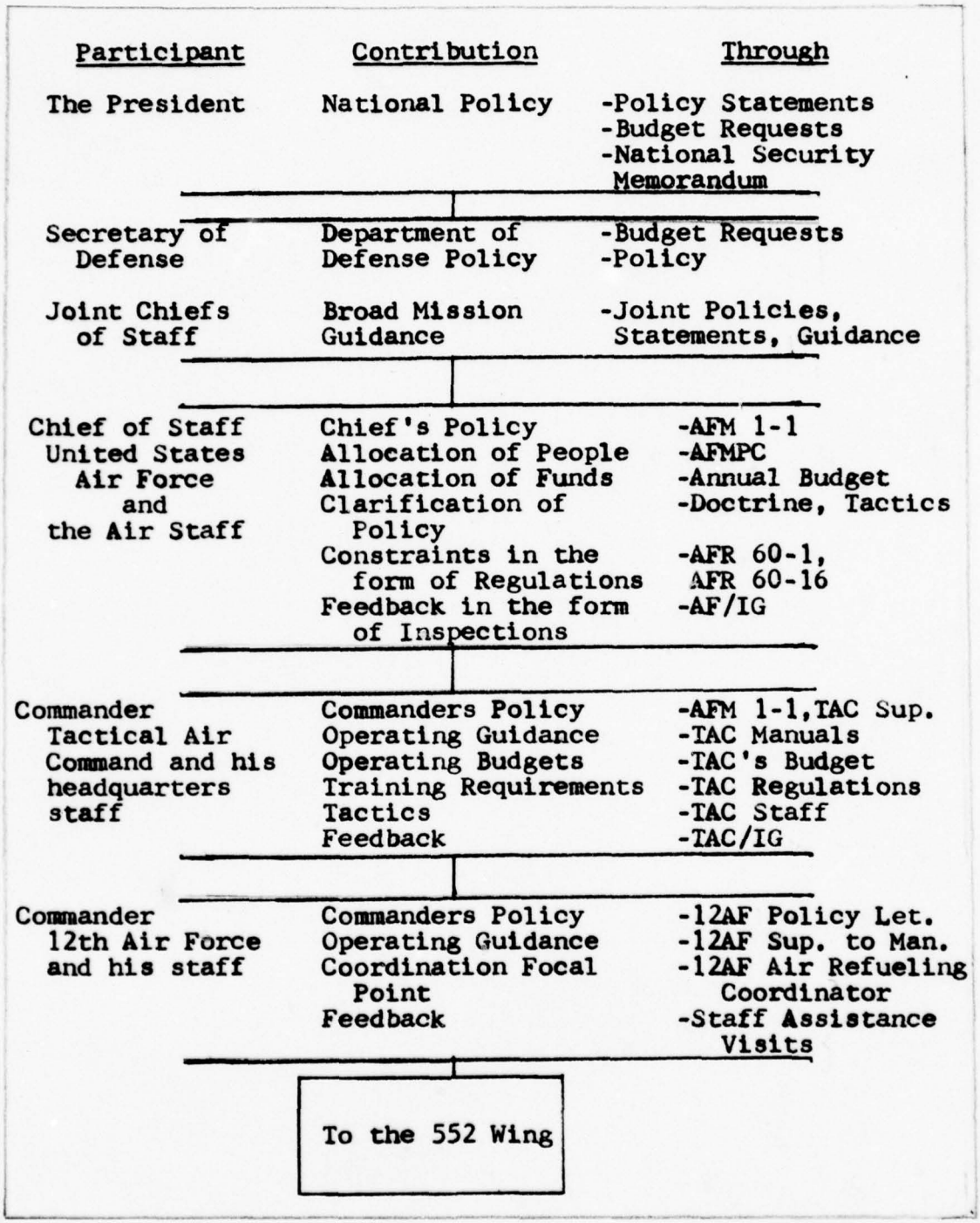


Figure 12. External Inputs in the ASM

for development of specific plans. DOA also develops the scheduler's basic guidance (Refs 22-24), the training plan (Ref 22), and the procedures for operations with other commands (Ref 40). These are distributed to the AWACW for action and compliance. Finally, TAC provides supplements to Air Force regulations when needed.

TAC agencies supply resources to the AWACW for use in its operations. These are assumed to be in operation for this thesis. Likewise, the AWACW has been designated as the sole operator of E-3A aircraft. These aircraft are assigned to the AWACW as they are completed by Boeing. DOCA also coordinates the budgetary allocations and assigns them directly to the 552 AWACW.

The final input from TAC, feedback, may come from the TAC Inspector General (TAC IG) if that agency is the one conducting the evaluation. TAC IG acts just like the AF IG in this case, specifying action if needed.

Numbered Air Force. In the case of the AWACW, its parent NAF is the 12th AF at Bergstrom Air Force Base, Texas. In practice, this organization has little to do with the E-3A operations. The NAF provides some guidance constraints for wing operations. It also supplements Air Force and TAC publications when needed and supplies feedback by means of staff assistance visits. Its main function with respect to

the scheduler and the ASM is to act as a focal point through which the wing coordinates its tanker requests.

Other Commands and Agencies. A great deal of the 552 scheduler's time is spent coordinating between his wing and other agencies. These external participants are the sources of the resources (aircraft, airspace, and time) that the wing needs to accomplish its activities. A list of these organizations includes SAC, NORAD, ADCOM, ANG, AFRES, the Navy, the Army, and any other government agency that works with or needs the E-3A's unique capabilities. Each organization has its own rules, regulations, and operational procedures. The wing schedulers must operate effectively and efficiently with each outside organization. It is essential that the schedulers obtain the external resources in the proper quantity and at the correct time in the training cycle.

These are the external participants, the ones the scheduler must work with in order to formulate the schedules. The next task will be to introduce the internal participants, the agencies in the 552 AWACW who influence the schedule.

Internal Participants

The internal participants are those that are a part of the 552 AWACW. The ones applicable to the ASM are the wing commander (CC), the vice commander (CV), the Deputy Commander

for Maintenance (DCM), the Deputy Commander for Operations (DO), the many DO agencies, and the squadrons. Each internal participant will now be described in turn. Figures 13 and 14 have been provided in the text to aid in this explanation.

Wing Commander. The CC is responsible for the entire AWACW operation. That is, he must turn all the guidance, aircraft, and people into an effective organization. He does this by means of his staff. He also adds his own management philosophy and interpretation of the existing guidance. An important CC contribution to the ASM is his ordering of priorities in wing operations.

Vice Commander. The CV adds his management philosophy to the guidance available for wing operations. In addition, he acts for the CC while the commander is not on station. These are the only two contributions made by the CV for the ASM.

Deputy Commander for Maintenance. The DCM is responsible for the AWACW maintenance effort and the implementation of the CC's policies and guidance. He adds his own management philosophy while carrying out his assigned duties. The scheduler is concerned with one DCM agency for the aircraft (E-3A) resources. This is the maintenance scheduling office. The wing scheduler must negotiate with the maintenance

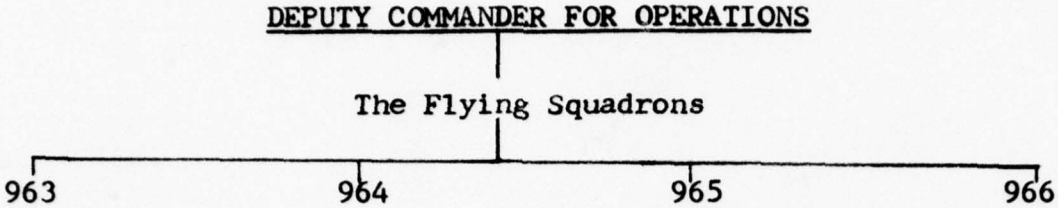
Participant	Contribution	Through
Wing Commander	Policy and Management Goals to put all the external inputs into a coherent fighting force. Establish his staff to carry out this task.	-AFR 23-XX -Wing Operating Instructions -Personnel Direction

Deputy Commander for Operations	Deputy Commander for Maintenance
-Responsible for the Operational portion of the wing meeting the Wing Commanders Goals.	-Responsible for the Maintenance portion of the wing meeting the Wing Commanders Goals.

DO Agencies	
Director of Training	-Overall Training Coordinator
Standardization and Evaluation	-Aircrew Evaluators
Life Support	-Aircrew Trainers
Mission Developer	-Planners
Current Operations	-Monitor Current Wing Operations
Flight Records	-Data Monitors on Flight Related Items
Squadrons	-Furnish the Crews

DCM Agencies
Maintenance Units
Maintenance Complex Scheduler

Figure 13. The Internal Participants for the ASM



Participant	Contribution
Squadron Commander	Responsible for people assigned to be mission ready
Squadron Operations Officer	Responsible for carrying out the Commanders orders
Squadron Flying Scheduler	Works with the Commander and Operations Officer to schedule aircrews against wing commitments and provides inputs for resources to train the squadron's crews
Squadron Ground Scheduler	Same actions as above except he works ground training items
Squadron Flight Records Manager	Maintains the Squadron's Aircrews Flight Records and operate the TAC Aircrew Training Computer (TAFTRAMS)

Figure 14. A Squadron's Position and Contribution to the ASM

scheduler, who represents the DCM, to obtain the aircraft resources to fill the sortie requirements for training.

Deputy Commander for Operations. The DO is responsible for the operational aspects of the AWACW. These portions include flight operations, training, and scheduling. He adds his own management philosophy to the situation. To aid him, he has an extensive staff of DO agencies to handle the many functions. The ones affecting the schedule will be explained in the next section.

DO Agencies. The DO agencies that play a part in the ASM are the Director of Training (DOT), Wing Scheduling (DOOK), Standardization and Evaluation (DOV), Aircrew Life Support (DOTL), and Current Operations (DOX). Each will now be explained in turn while specifying their roles in the schedule.

The first DO agency is the DOT. This man is responsible for the wing training effort. He adds his guidance and management philosophy and supervises the wing scheduling office.

DOOK is composed of three branches called ground training, flight scheduling, and simulator scheduling. Each branch schedules the areas as suggested by the titles. The ground training scheduler is responsible for scheduling ground items such as pistol shooting, drug abuse training, and the human relations courses. The flight scheduler

schedules aircrews, missions, supervisors of flying, and anything else that concerns flight missions. The simulator scheduler schedules flying personnel for activities in the mission or flight simulator as applicable.

DOV provides several important inputs to the scheduler. First, the Stan/Eval agency evaluates the aircrew's performance in the flying portion of the mission. If the observed results are unsatisfactory, DOV provides feedback which causes changes in the schedules. In addition, Stan/Eval monitors the required evaluations and keeps the schedulers advised of the ones required for each crewmember.

DOTL is responsible for training the crews in the use of all the life support equipment installed in the E-3A. This agency supplies the training requirements for the flying personnel for inclusion in the ground training schedule.

The final DO agency is DOX. This agency plans specific missions or exercises and plans the way the wing will meet its war commitment. In addition, DOX personnel attend the exercise and planning conferences as the 552 AWACW representatives. This organization supplies inputs to the scheduler in the form of specific missions that must be fulfilled.

The Squadrons. The final internal participant is the squadron. This term will refer to the squadron commander, operations officer, and squadron staff. Figure 14 shows

their relative positions. There are four squadrons in the AWACW, the 963rd, 964th, 965th, and 966th squadrons. These organizations supply the personnel to be trained.

The squadron commander is responsible for the operation of the squadron. He adds his management philosophy and guidance to that already present. He is aided by the squadron operations officer. The squadron flying scheduler and the ground training scheduler work for the squadron commander and interact with the DOOK. The squadron schedulers provide inputs to the wing schedulers; these are in the form of numbers and types of flying missions required and specific ground training requirements. This will later be shown as the beginning of the scheduling process. In addition, both squadron agencies allocate the personnel to the missions and ground training items as given by the wing schedulers. This is the last stage of the implementation of the schedules.

There is one more situation concerning the squadrons that should be mentioned. There are four squadrons in the 552 AWACW. Three are operational squadrons composed of mission-ready personnel. The fourth, the 966th, is the organization charged with the initial upgrade of new personnel in the E-3A. As a result, this squadron has requirements for a set number of missions on certain days with specific activity to permit a smooth training flow to the initial upgrades. Also, it is possible to transfer

instructor personnel from the other squadrons to the 966th with no expense to the government. This can have a detrimental effect to the schedulers if the missions for the operational squadrons were planned for a certain number of personnel and a substantial number of them were moved to the 966th.

This has been a brief overview of the internal wing participants and their roles in the ASM. The next section will specify the resources that the scheduler needs in order to fulfill the demands of the wing and command in order to fulfill the wing's mission.

Resources

The resources used in the ASM will be enumerated by source, either internal or external. Appropriate discussion will be included to illustrate the critical importance of the external resources. Also, the two E-3A training scenarios will be explained to show how the resources are used.

Internal Resources. The 552nd AWACW provides only two of the five resources used in the ASM. These are the E-3A aircraft and the crews. All other resources must be procured from outside agencies to allow the AWACW resources to be used.

External Resources. There are three types of external resources used in the ASM. These are range times, airspace, and aircraft.

The first two resources, the times and airspace, are negotiated at the AWACS Quarterly Scheduling Conference and the SAC Air Refueling Conference for fighter aircraft and tanker support respectively. It must be noted that most SAC and TAC wings operate their own weapons ranges. In addition, all SAC wings control at least one air refueling track. The 552nd AWACW possesses neither ranges or tracks. So, the acquisition of these items becomes critical. Also, they must be obtained at the proper times in the training cycle to ensure timely completion of crewmember upgrade and enable the mission ready crewmembers to complete the required continuation training.

The third external resource is aircraft, both tankers and fighters. The tankers are negotiated at the SAC conference previously mentioned, and the fighters are negotiated at the AWACS Scheduling Conference. The tankers are used for E-3A pilot proficiency purposes, while the fighters are used for the AWACS mission crew activities. As with the time and airspace, the resource flow for external aircraft is important for timely upgrade and continuation training activities.

Use of Resources in Training Scenarios. The external resources are used along with the AWACS aircraft and crews in two types of training scenarios. These are the air defense (M-A) mission and the tactical (M-T) mission. Summaries of the mission requirements are included in Appendix E. First some general comments will be made specifying considerations common to both scenarios. Then each will be briefly explained to show the use of the external and internal resources.

In general, both the M-A and M-T scenarios require the use of a tanker for the E-3A. This requirement is not only for aircrew proficiency, but also for the fuel transfer. The fighter operating airspace is either along the west coast, the Canadian border, or the east coast. The long distances from Tinker Air Force Base to these operating areas cause the long mission durations and the requirement to onload fuel. In addition, both scenarios require that the AWACS aircraft and crew be scheduled for a minimum of three hours of time in the particular operating airspace. Current policy specifies that this time be increased to four hours. Further, the activity must be monitored by a ground radar unit. This is a particularly significant constraint, as it severely limits the areas for conduct of the training exercises. In the near future the E-3A will be certified as a military radar unit (MRU). This will help with the airspace problem and enable the AWACS operation to include

fighter units that cannot operate in current operating areas because of distance considerations.

The M-A training sortie is the classic air defense scenario. This is used for both upgrade and continuation training. The mission crew requires the use of twelve to eighteen fighters to accomplish the required training events. These events are intercept activities, both one-on-one and two-on-one. Further, they must be on non-maneuvering targets. In addition, the mission crew must accomplish a fighter-tanker rendezvous, ECM training, and air-to-ground computer tie-in procedures (TADIL-A interface) (Ref 48).

The M-T sortie is called the tactical scenario. Again, this is used for both upgrade and continuation training. The fighter resources needed, the ECM training, and computer interface requirements are the same as for the M-A sortie. Also, the fighter-tanker activity is the same. However, the mission crew activities are more directed toward the tactical uses of the E-3A. The mission crew directs the fighters through air combat tactics and dissimilar air combat tactics. An example of the first would be activity with an F-4 against another F-4. The second would be combat situations involving unlike aircraft such as an F-15 against an F-4. In addition, the mission crew would also direct fighters to a rendezvous with a forward air controller for close air support and interdiction activities (Ref 48).

Now that the five types of resources and their uses have been explained, it is time to incorporate them with the participants into the ASM and produce a schedule. This will be the topic of the next section.

The Scheduling Model

On July 21, 1978, Major Jack Morris, an E-3A aircraft commander and his flight crew flew a nine and one-half hour sortie. During that mission he refueled once, accomplished one takeoff, one approach, and one landing. The mission crew controlled the friendly fighter forces at a Red Flag exercise. These forces were composed of SAC and TAC aircraft performing strike, interdiction, and close air support missions. The six controllers directed many air-to-air intercepts against attacking aggressor aircraft. As a result of their efforts the Blue Force was able to maintain air superiority over the attacking Red Force.

This was just a normal 552nd mission planned by the scheduling model used by this wing. This sortie, as well as the rest of the sorties flown by the AWACW during the third quarter of 1978, were scheduled at least ninety days prior to the date of flight. The purpose of this section is to explain the ASM as used by the schedulers. The explanation will cover the inputs and scheduling process, the output, and the feedback.

The Inputs and Scheduling Process. The inputs and scheduling process form the first two parts of the ASM. Figure 15 has been included to aid in explaining these elements.

The scheduling process begins prior to the beginning of the calendar quarter prior to the actual quarter for which the missions are to be scheduled. As an example, for missions flown in the January to March quarter, the process would begin in the previous July to September time frame. The scheduler's first action is to review all the available guidance, both external and internal, to see all the considerations that will be used in the process. At this point in time he is ready to begin work on the first schedule, the quarterly (See Appendix J for flow diagrams of quarterly/monthly scheduling processes).

Actual work to develop the quarterly schedule begins at the start of the quarter prior to the one under consideration. In the example, this would be at the start of the October to December quarter. Again, the scheduler reviews the guidance. He must use this during the development of all the schedules. At the same time he consults the flying time allocation from TAC DOA and notes any higher headquarters commitments, for example, alerts, TDY's, or special missions. He places the commitments on a planning calendar on the appropriate dates along with the appropriate resource requirement. This information becomes another constraint.

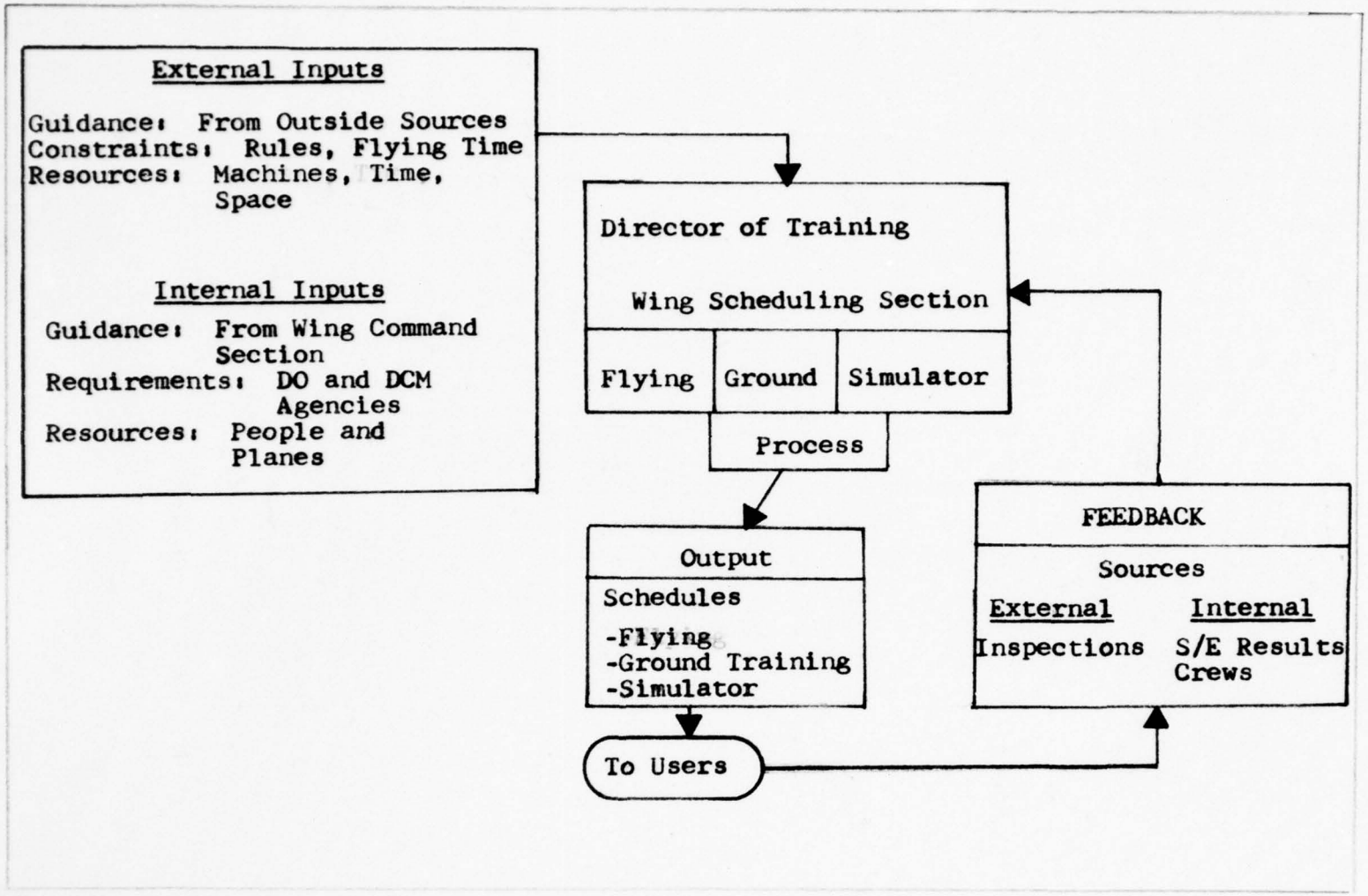


Figure 15. Scheduler's View of Both Internal and External Participants, Resources, and Feedback Involved in the ASM

Next the scheduler receives inputs from each of the four squadrons at the AWACW. These are the number of sorties, both training and proficiency, that each feels will be needed for the upcoming quarter to maintain the crews' currency and proficiency. The squadrons use a standard planning factor of two sorties minimum each month for each flight crew and each mission crew (Ref 22:4-2-3 and 4-5). The 966th sortie request contains not only the number of sorties required to maintain the currency of the instructor force, but also the number of sorties needed for initial training of student crews and the number of air refueling training sorties required to train new E-3A pilots in air refueling. This last type is called the "Lift Sortie."

All this information is tabulated. It represents the total number of sorties needed by the squadrons for their operations. This figure is then added to the number needed for known HHQ commitments. The scheduler adds a ten to fifteen percent "pad" to this total to account for the estimated mission aborts, weather cancellations, and losses due to other reasons. This new total becomes the total number of sorties required for AWACW operations for the quarter concerned. This will be used by the scheduler as he acquires the external resources. This part of the scheduling process is completed in the first month of the quarter preceding the one for the flights, September in the example.

With the sortie information, the AWACW scheduler is now ready to attend the first resource allocation conference, the E-3A Quarterly Scheduling Conference. This conference is held at least eighty-five days prior to the new quarter (Ref 49:2). Here the wing obtains the fighters, airspace, and time for training. This meeting is attended by representatives from TAC, TAC's two NAF's, exercise planner from HQ/TAC, ADCOM, representatives from each NORAD Air Division, the Navy, some TAC fighter wings, and other interested agencies (see Appendix F for attendance lists) (Ref 49:2).

The AWACW scheduler conducts the conference by presenting each mission, day by day, for the quarter. The higher headquarters missions are pre-allocated. The upgrade sorties are allocated for each day. Then the continuation training sorties are made available to the using agencies. This continues until all sorties are allocated or the units stop bidding on them.

Upon termination of the proceedings, the participating units return to their home station and await the final copy of the meeting results. The E-3A scheduler makes any changes and distributes the information to the units at least ten days prior to the start of the new quarter. The final copy of the meeting results is a contract for operations. Any changes will be relayed and confirmed with the unit by the AWACW scheduler on the day prior to the scheduled mission (Ref 49:3 and Ref 30:5).

AD-A069 745 AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCH--ETC F/G 15/7
AN EVALUATION OF MAIN OPERATING BASE SCHEDULING PROCEDURES OF T--ETC(U)
MAR 79 L W SAUNDERS, J D YOUNT

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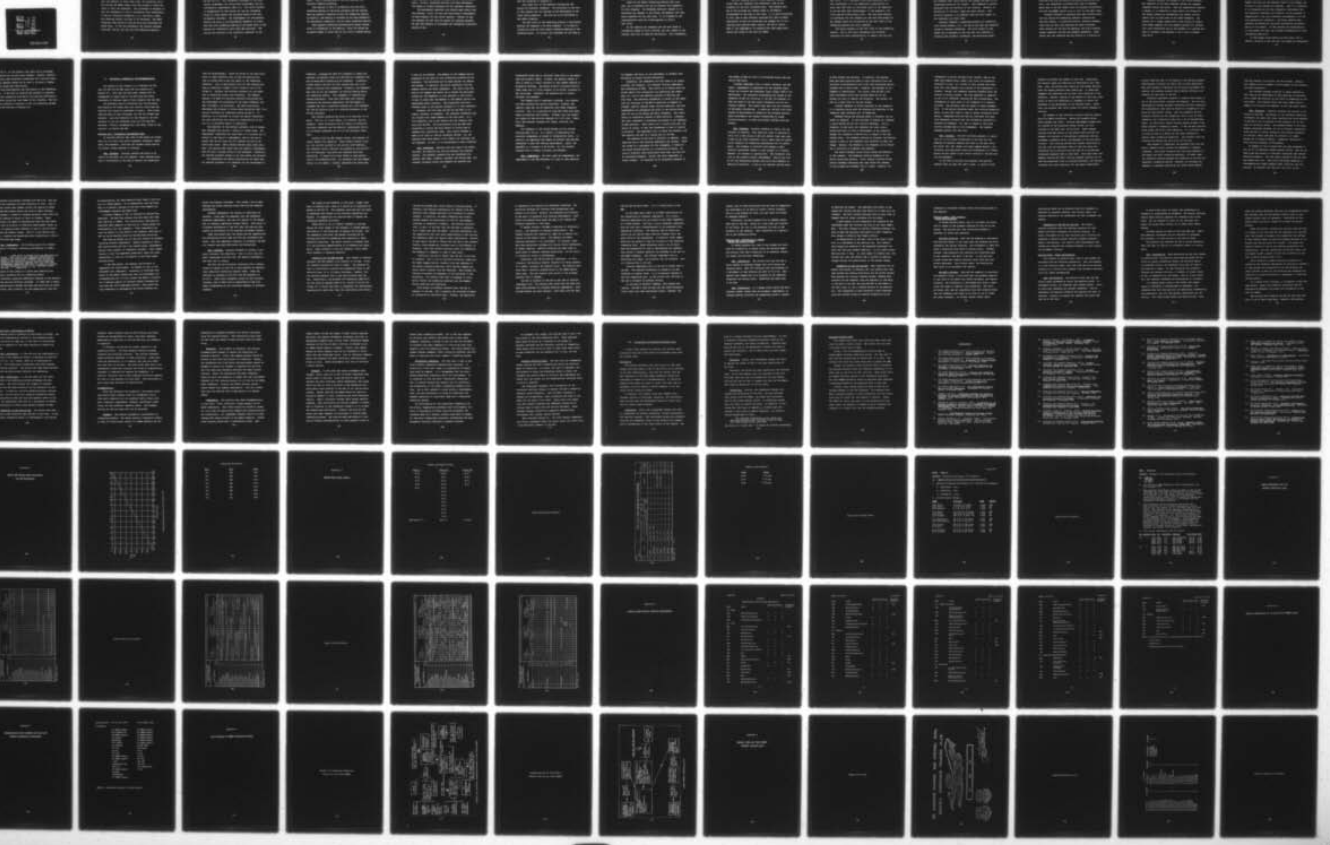

Once the fighter-related resources have been acquired, the scheduler is ready to negotiate the compatible tanker resources for use to complete the training missions. This task is accomplished at the SAC Air Refueling Conference, a part of the Combined RBS/Tanker conference mentioned in Chapter IV. It is held no later than forty days prior to the beginning of the quarter (Ref 41:3). This date may change under a planned revision to the manual concerning KC-135 usage. There is much resistance to this proposed change from ADCOM, TAC, and especially the 552 AWACW due to conflicts with scheduling conferences involving other commands.

The E-3A scheduler formulates his tanker requirements and passes them to his NAF, 12th Air Force, for transmittal to SAC/DOOK, the SAC single tanker manager, and to both SAC NAF's, 8th AF and 15th AF (Ref 41:3). These organizations pass the requests to their bomb wings, air refueling units, and the ANG and AFRES tanker units who attempt to place the needs in their own schedules. This procedure is designed so that the conference is used to accomplish final coordination to the air refueling information, i.e., the dates, times, air refueling tracks, and fuel to be offloaded. The AWACW schedulers then attend as 12th AF units and coordinate the tanker data. In the two conferences the writers attended, a SAC NAF, 8th AF, has lost the E-3A refueling requests.

If things work according to plan, the scheduler returns to Tinker Air Force Base with all his tanker requests filled. The final tanker contract will arrive at the 552nd not later than ten days prior to the start of the new quarter (Ref 41:3). The scheduler will crosscheck this information with that from the conference and make adjustments as necessary.

At this point, the scheduler has most of the inputs necessary to start the development of schedules. He then checks the flying time available and plans the durations for the sorties to use this time. In practice, the AWACW has turned back flying time every quarter, due to a slow aircraft delivery and the resulting reduced output of new crewmembers from the 966th AWACS.

The flying scheduler next meets with the maintenance scheduler to work out the sortie generation contract (Ref 4:2 and Ref 26:1-2). The information exchanged is the total sorties programmed, the flying hours programmed, and the configuration requirements (Ref 4:1). The sortie contract is renegotiated for each month, but the two succeeding months of every quarter are projected based on the best information available. The requirements for the upcoming quarter are given to the maintenance scheduler not later than the first scheduling meeting of the month prior to the quarter for coordination with other DCM personnel. The results are returned to the operations scheduler by the

second scheduling meeting of the month before the flights. The later information is retained for planning purposes. The information in the sortie contract is the same as in the SSM, that is, the number of flights each day, the takeoff time, the approximate duration, and any special requirements.

It is to be noted that the specific sortie contracts are negotiated each month. Because of this, there may be even more losses of sorties for the E-3A. If maintenance cannot supply an aircraft, operations does not fly the mission.

At this point in the planning cycle, the scheduler assembles the information for each sortie. All that is known at this time is the approximate takeoff time, the external resources available, the approximate landing time, and the sortie type (M-A, M-T, or Lift). The final input to complete the sortie planning is the assignment of the aircrews. This is accomplished at the next meeting, the Quarterly Scheduling Meeting.

This meeting is held in conjunction with the first scheduling meeting of the month preceding the new quarter. Here the squadron schedulers rejoin the scheduling process. In addition, the meeting is attended by the wing schedulers, the maintenance schedulers, and any other interested parties.

Each squadron scheduling representative brings several kinds of information to the meeting. First, he brings the projected number of crews that he will have to manage during

the quarter. Second, he brings specific information such as check ride requirements, leave schedules, alerts, TDY's, and any other reasons that a crewmember would not be available for flying activities. Each scheduler also brings any particular guidance supplied by his commander.

The squadron schedulers then sit down and go through the quarterly schedule day by day and bid on the sorties. According to the CC's policy, the 966th has priority on any sortie due to its training function. Otherwise, the first bidder gets the sortie. When all sorties have been allocated, the meeting is adjourned. These commitments then become a firm contract for the squadrons. As previously mentioned, each operational squadron schedules at least two sorties for each crew. In addition, each flight crew also gets one pilot proficiency sortie per month. These appear to be the only decision rules present for the squadrons. Further, the 966th scheduler has specific guidance for his sortie requirements. He has a projected training flow which determines the number of flights necessary for his quarterly operations.

The maintenance scheduler also obtains some inputs from this meeting. First, he uses the first month's requirements as hard requests for the sortie contract. Second, he uses the requests for the next two months for planning purposes. He uses this meeting to crosscheck the information previously passed to him.

The ground training and simulator schedulers attend this meeting to preview the flying schedule. Their interest is in crew availability in order to prevent a crewmember from being scheduled for two activities at the same time. Throughout the scheduling process, the ground training and simulator schedulers work around the flying schedule. Their schedules are published with the wing's weekly schedule.

The squadrons provide training inputs to these schedulers in the form of requested commitments per month. They are either changed or confirmed at the wing scheduling office no later than 1200 hours the last duty day of each week so that they can be incorporated into the schedules for the second succeeding week. These commitments are then monitored by the wing and squadron level schedulers.

The wing scheduler then takes action to publish and distribute the schedule. Appropriate samples and other data are presented in Appendix H.

This takes care of the quarterly meeting and the ground and simulator schedules. The discussion in the rest of this chapter will be confined to the development of the other flying schedules. The next one to be considered is the weekly schedule.

The next level of the scheduling process is the monthly meeting (see Appendix G for flow diagram). It is held in conjunction with the first weekly scheduling meeting of the preceding month. Its purpose and attendees are the same as

at a weekly meeting (Ref 30:4). However, instead of bidding on sorties, the squadrons are informed of any changes that might have occurred to the schedule or they, in turn, inform the wing of any changes that have occurred within their organizations that might affect their sortie contract.

Although this description sounds like there is no communication between the squadron and wing schedulers until a meeting, this is not true. There exists a very open, informal, and vital communications network which provides an information flow to all concerned. This keeps all schedulers abreast of any developments, either actual or planned, that might affect their schedules. This informal network operates at all levels of the scheduling process, both internally and externally to the wing, but it is most effective and apparent at the wing level. The process now goes to the most worked level, the weekly schedule.

There are two weekly scheduling meetings held each week, one on Wednesday and one on Thursday (see Appendix G for flow diagram). The Wednesday meeting's purpose is to coordinate any changes in the flying, maintenance, and simulator schedules for the next week. It is attended by the representatives from the listed agencies in Table I (Ref 30:5).

At this meeting the squadrons get the last piece of information needed to plan a mission, the tail number of the aircraft that will be used for the mission. This information

Table I

Ateendance List for the Weekly
Wednesday Scheduling Meeting

Current Operations	Field Training Detachment
Aircrew Training	Standardization
Squadron Schedulers	Operations Plans
Maintenance's Scheduler	Mission Support
Training Development	Wing Schedulers
Any Interested Party	

was passed by the maintenance scheduler to the operations scheduler on the Monday prior to the Wednesday meeting (Ref 43). This information is passed at this time so that the wing scheduler can print copies of the schedule in time for this meeting and the information will be as accurate as possible.

The real working portion of this meeting, however, occurs when the schedulers are presented a copy of the schedule for the next succeeding week. They examine this day by day and make any changes based on information disseminated by the wing at this time. It is also distributed at this time so that everyone concerned will have an ample opportunity to make and coordinate any changes due to lost training from previous weeks sorties, new TDY's, leaves, DNIF's, new commitments, or anything else that might occur during the course of the next two weeks.

The Thursday meeting's purpose is to obtain the Wing Commanders approval of the maintenance, flying, and simulator schedules (Ref 30:6). The attendees at this meeting represent the same organizations that were at the Wednesday meeting except now, they are the section chiefs along with the DO, the DCM, and the Wing Commander or their designated representatives. Along with the approval of the schedules, this meeting reviews the previous weeks scheduling effort and its results. This provides an opportunity for feedback by the section commanders so that everyone can express their views on how well things are going. It also allows for inputs of guidance into the system from these sources (Ref 30:6).

Once this meeting is adjourned and the schedule approved, it is taken by the maintenance scheduler for reproduction (Ref 30:6). It is returned to the wing scheduler, who in turn distributes it to the appropriate organizations no later than 1200 hours on the Friday prior to the beginning of the new week (Ref 30:Attachment 2) (see Appendix I for title page and distribution list). The wing then operates in accordance with the schedule for the next week except for any changes which are distributed by the last level of the scheduling process--the daily schedule.

This daily schedule is the last level of the scheduling process. Due to the wing's dependence upon external resources and their susceptibility to change, the wing has

developed the daily schedule. It provides the latest information on missions and is used by the aircrews to accomplish their mission planning the next day. It is completed and published only after the wing schedulers have completed their daily coordination effort (see Appendix I for this list). It is published and distributed by 1630 hours on the day prior (Ref 30:6).

Output. The results of the scheduling process are the quarterly, the monthly, the weekly, and the daily schedules. Each is a subset of the previous one with a more detailed and accurate information picture on the sortie. They are the results of the process just described and examples of each can be seen in Appendices H and I.

Feedback. The final portion of the scheduling model is the feedback loop, which defines how changes are made to the scheduling system and its outputs. This feedback is usually generated from the execution of the schedule. However, as pointed out in the text, there are other sources. This section's purpose is to enumerate them and their impact on the schedulers and their work.

External feedback is generated annually by inspections from outside sources, i.e., the TAC IG and when the scheduler attends a resource conference. The first source is very formal and is designed to tell how well the scheduler is following the guidance, procedures, and directives within

which he must operate. Their impact on the schedule is one of the primary sources for change. If the IG says change, then change he must. Very seldom does the IG suggest a better way to do things. Basically then, this formal external feedback source provides an evaluation on how well the scheduling process conforms to the regulations.

The feedback received at the resource conferences is very informal. Usually it is the external source's view on how well the wing's scheduling effort is working. This is a very important source of feedback for it affects how cooperative and easily these sources will work with the wing. For example, if the wing's reliability record with a certain unit is high, this unit will seek out and cooperate with the wing. If the reverse is true, then the unit may shy away from the E-3A wing and possible training opportunities are lost. The researchers discovered this type of feedback among some of the ANG tanker units and through conversations with ANG and AFRES fighter units as well as with SAC's DOOK.

Internal feedback is generated from many sources within the wing during the scheduling process's planning and execution phases. As mentioned earlier, planning feedback comes from the many wing meetings and their attendees. Other sources are the many DO agencies, the wing's mission support agencies, and the crew members themselves. Their impact upon the scheduler and his efforts is a function of

the level of feedback source within the wing and the impact it might have on his organization, i.e., its seriousness and complexity. The higher the source within the wing or the more minimal the effect, the more likely it is to be incorporated.

Execution feedback is received from many sources and at any time. The following is the wing's method for handling these changes. Any change to either the flying, maintenance, or simulator schedules must be approved by the DO or his designated representative. Any change that specifically affects a missions takeoff or landing time, or the maintenance preflight requirements must also be coordinated and approved by the DCM or his designated representative prior to its submission to the DO for his approval (Ref 30:8).

Normally requests for changes to the flying schedule are submitted to the wing scheduler through the squadron scheduler during duty hours. When the organization requests a change, it is submitted in three parts; the reason for the change, method for implementing the change, and any impacts that it might have on any other schedules. The sources for a change ranges over a wide variety of causes. Some common examples are crew members getting ill, printed fuel load insufficient due to the weather, or a printed call sign is incorrect (see Appendix J for a list of others) (Ref 30:7).

Most internal changes originate at the squadron level, and the squadron affected is the first level to attempt to arrive at a solution. For example, if a crewmember gets ill he can be replaced by another from within the same squadron. However, if the source of the change is external to the squadron or wing, or no solution can be found from within the squadron's resources; then the wing along with the other squadrons work on the problem. Research through interviews with squadron schedulers has found that it has taken up to nineteen manhours per week just to arrive at methods for changing schedules. At the wing level, at least one-third of the day is spent in this area.

Once a solution has been found, either within or between squadrons, or between the wing and maintenance, or between the wing and the external source of the change, the solution is sent forward for approval. Once it is approved, it is documented by the wing schedulers, maintenance and the simulator schedulers are notified, and the approval is communicated to the unit concerned (see Appendix I for the wing coordination checklist). The daily schedule then provides the medium for wing-wide notification and confirmation of the change. It then becomes the responsibility of each agency for their own internal dissemination of this information (Ref 30:7).

If the change occurs during non-duty hours, and it affects a mission on the next day, the change is coordinated

through the wing's command post. It is their responsibility for coordinating the change with any external or internal agencies. A change of this nature might be the cancellation of a tanker scheduled to refuel a mission the next day due to that unit being given a no-notice operational readiness inspection. A summary of these changes is then sent to the wing scheduler by 0800 hours the next morning (Ref 30:7).

An additional source of feedback is from the review of post mission paperwork. This source was not used during the initial research on the scheduling process. However, since then the wing has begun using this source. This provides both the wing and squadron schedulers documentation on the amount and type of activity accomplished during the sortie. This information will clue the wing scheduler to possible rescheduling efforts by the squadrons, since they are the agencies responsible for making up for lost training.

This, then, completes the feedback portion of the flying schedule; attention will now be directed toward making changes in the simulator schedule.

Changes to the simulator schedule that occur during normal duty hours are sent to the wing simulator scheduler. The request format, method of approval, and approval authority are the same as for a flying schedule change. Again once it is approved, it is documented, and the affected agencies notified. It is then their responsibility to disseminate the change throughout their own organization

(Ref 30:7). At the present time there are no published procedures for non-duty hours changes. However, research indicates that procedures established for a non-duty hours flying schedule change can be used in the event a change occurs during that time period.

This, then, completes the description of the scheduling model. It has been as detailed and accurate as possible with the information provided by the wing and publications in effect during the time frame of this research. The next chapter presents an analysis of the two scheduling systems using the criteria of Chapter III.

VI. Evaluation, Comparison, and Recommendations

The purpose of this chapter is to evaluate and compare the SSM and the ASM using the five questions of Chapter III. Once this has been done, changes will be recommended to those areas in the ASM which are rated inadequate in absolute terms or when compared with the SSM.

The procedure used for evaluation was the following. Each question was broken down into specific areas that the analysts felt should be considered in detail. Each system (SSM and ASM) was then evaluated, and the two systems were compared. Upon the completion of this sequence, the next question in turn was addressed until all five had been answered. Finally, recommendations were made, based on this analysis, to improve the ASM.

Question One: Information and Resource Flow

To consider Question One, each of the models was broken down into its four input parts; guidance, resources, commitments, and feedback. Each part was further broken down by its source, either external or internal.

SSM: Guidance. External guidance was found to be timely and accurate, but not adequate. Most external guidance is distributed in the form of manuals and regulations

(see the Bibliography). These are passed to the bomb wings prior to their effective date so that the agencies are able to review them to see the impact on the scheduling operation. This is particularly true for the training program as specified in SACM's 51-52, Volume IV and 51-135, Volume IV. Further, the available guidance for the scheduler is specified clearly and accurately. For example, Chapter 3 of SACR 50-9 provides detailed instructions for the development and processing of the three schedules, the MOP, the weekly, and the daily. SAC bomb wing mission developers are directed to follow these guidelines (Ref 13:i) and are evaluated for compliance during the ORI's. In addition, it is possible to consult the agency responsible for each publication and receive an interpretation of any part of an applicable manual or regulation.

The remainder of the external guidance, such as management thoughts from the AD's, arrives at random times. The researchers' experience has shown that it is accurate and is usually in the form of a requirement, such as the one to ensure that the DO flies two B-52 sorties and one KC-135 sortie each month. While random arrivals could cause problems, the analysts have noted that the specific requirements have had only a minimal effect on the schedules. Therefore, the external guidance appears to be both timely and accurate.

The examination of current publications has shown that the external guidance is not adequate for the development of

schedules. Although the SACR 50-9 guidance is timely and accurate, no decision rules are specified for tradeoffs that must be made while formulating the schedules. Lieutenant Colonel Angell (see Ref 33) also pointed this out in his thesis on missile crew scheduling. Presently, the scheduler must rely on his own judgement for decision making during the scheduling process. This judgement is improved only through experience. From both interviews with aircraft schedulers and personal experiences, the development of judgement has been a particular problem for a new scheduler. The lack of decision rules is a definite hindrance to the mission developer.

The internal guidance was found to be deficient in all areas. That is, it is not timely, not accurate, and not adequate. These evaluations are the result of interviews with many schedulers and the analysts' experiences both as a B-52 mission developer and as a KC-135 Stan/Eval scheduler.

Guidance from the BMW command section (see Chapter IV) rarely reaches the scheduler. These people normally interact with the DOT and DOTT at the various staff meetings. The scheduler usually receives the guidance at the Pre 60-9 and 60-9 meetings, long after the schedules have been formulated. It would be far more useful at some earlier time in the scheduling flow. So, guidance from the command section is not timely. Further, experience has shown that

it may not be accurate. The members of the command section frequently do not have all the information possessed by the scheduler. The directions may be vague and may not address the problem. In addition, the policy guidelines from the command section are often inadequate. The inputs from this area do not suggest any better way to handle the particular situations; the scheduler is only directed to take action. It must be noted that the members of the command section are experienced senior officers. This experience could be a valuable asset to the mission developer if it were available.

Likewise, the flow from the DOT and the DOTT is not timely, accurate, or adequate. The scheduler frequently does not interact with these members of the wing staff. As a B-52 scheduler, one of the analysts did not interact even once with the DOT. The consultations with the DOTT were restricted to asking the total amount of flying time to schedule for a particular week. This usually changed to make up for time not used by cancelled sorties. So, the guidance from these people is not timely, not accurate, and not adequate. In fact, it is non-existent in many instances.

SSM: Resources. Resource flow was found to be timely, accurate, and adequate for both the external and internal sources. The external resource flow was considered for tankers, RBS times, fighters, airspace, and flying time. All external resources except the fighters are procured and

coordinated within SAC at specified times prior to the moment they are actually needed. Further, the quantity needed of each is based on a wing's estimate of that number required to accomplish training. The amount actually allocated fulfills these needs and is a firm contract to be filled, according to SAC philosophy. Therefore, the resource flow is timely, accurate, and adequate.

The fighter flow is sometimes a problem. The fighters and their airspace are usually available. However, the specific times may not be compatible with other scheduled activity. But, it is possible to trade RBS times with other wings to alleviate this problem. Further, only one fighter can supply all the activity required by a B-52 crew. Therefore, the external resources are timely, accurate, and adequate.

The scheduler is the single manager for all aircrew training (Ref 13:1-1). As a result, he manipulates the available crewmembers as needed to formulate his plans. In addition, he negotiates the number of aircraft with the DCM schedulers to meet the training requirements. Again, the agreement is a contract to be filled. So, the internal resource flow is timely, accurate, and adequate.

SSM: Commitments. The next input was commitments, the requirement to use BMW resources as a part of some exercise,

for example, Red Flag, or the requirement to schedule such activities as annual aircrew evaluations.

Externally, the commitment flow was found to be timely, accurate, and adequate. All external training commitments are coordinated by DOTO. This office is in contact with the actual agency (ies) responsible for generating the commitment (s), such as the exercise planners at Red Flag and Blue Flag. The pertinent information is passed to the scheduler for inclusion in the MOP as mentioned in Chapter IV. Further, specific takeoff times, mission durations, and fuel requirements are determined and given to the mission developer for use in the weekly and daily schedules. This information is continually updated by DOTO personnel. Likewise, the alert commitment is processed and passed to the scheduler by DOX personnel. These people are in contact with SAC, the agency of origin, so that the information is kept as current as possible. The commitment flow is timely and accurate, and the analysts see this as a strong part of the SSM.

The adequacy of the flow is difficult to measure. First, there are only a few training commitments per quarter. These are viewed as a supplement for the crewmember, a chance to use actual wartime tactics in a controlled situation. As long as different crews participate each time, the flow can be considered adequate. Second, the alert commitment is always present. Its guidance can be considered adequate if

the number of days on alert is distributed evenly over the entire crew force.

Internal commitment flow is timely, accurate, and adequate. Commitments of importance are the required evaluations for aircrews and functional check flights (FCF's) for maintenance. The evaluation requirements are passed to the scheduler by DOV for inclusion in the MOP (see Chapter IV). They are based on the best known information and are continually updated. The authors have seen very few instances of delinquent evaluations. In addition, the FCF's are coordinated by maintenance as needed for the assigned aircraft. These requirements are usually accomplished on normal training missions, so there are minimal problems with compliance.

SSM: Feedback. External feedback is timely, but not accurate or adequate. This important input is received at least once a year during an ORI and several times each year in NAF and AD staff assistance visits, where each one specifically examines the scheduling organization and its performance. The feedback is received often enough to help identify unfavorable trends; in this respect it is timely. However, its accuracy is questionable. The inspectors only look at the system's overall performance. They do not look at all the extenuating factors that drive the scheduler in making his decisions. A look at the complete picture would

be more helpful and accurate. In addition, the analysts have seen many instances where a staff assistance visit has uncovered no discrepancies and an ORI team discovered serious problems only a month later. Likewise, the adequacy of the feedback is questionable. The outputs from the ORI's and staff assistance visits show problem areas but do not present any ways to improve the situation. The writers see this as a major fault to the SAC system.

Internal feedback is always available to the scheduler. It is received during both the planning and execution of the schedules; each situation will be addressed.

Feedback during the planning phase is accurate, but not timely or adequate. As was discussed in Chapter IV, feedback is given during the Pre 60-9 and 60-9 meetings. This is untimely; at that point the scheduler has spent around twenty-five hours of work in development of the schedules. Changes are frequently directed with no regard to the time already spent. The feedback received is accurate; the desired change is given to the scheduler with direction to make the change. However, the feedback is not adequate, for no better way is specified to formulate the schedule.

The second feedback source occurs during the execution of the schedule. The scheduler receives feedback at two points during this portion. First, during a mission he may receive feedback indicating that some factor has changed. In this respect the feedback flow is timely. However, the

information is routed through filter centers, such as the bomb wing command posts, where vital facts are frequently distorted or lost. As a result of this problem with feedback flow, the adequacy and accuracy of the information is suspect. Second, the scheduler receives feedback after the mission at mission review. The crew paperwork is examined to see if all scheduled training has been accomplished. The information is later given to the scheduler on a computer printout. The procedure does not permit a timely feedback flow. If the mission developer needs the training accomplishments, he must wait nearly a week to obtain documented information. Experience with the SSM and interviews with bomb wing schedulers indicate that the information presented is accurate and adequate. All that is needed is the actual activity accomplished by each crewmember. The computer programs provide this very well.

ASM: Guidance. The ASM's external guidance is timely, that is, it is quickly distributed to the wing for use. Examples of external guidance are found in the many Joint, Air Force, TAC, SAC, ADCOM, and other command manuals, publications, and regulations which are distributed in a timely manner and are usable by all levels involved in the ASM (see the Bibliography).

In the area of accuracy and adequacy, the external guidance does not meet the user's needs. A source of this

problem is probably the newness of the E-3A. Identifying the system's needs and resolving its deficiencies will take time. Also, the writers were unable to find formal decision rules for making tradeoffs when scheduling. It seems that judgement and experience are the only tools available to the scheduler. However, because of the newness of the E-3A, there exists no basis for experience or judgement to assist the scheduler in the performance of his assigned tasks. Therefore, the guidance that exists cannot be totally adequate or accurate.

One example of this situation concerns training requirements for AWACS controllers. During the research period these changed four times. Training requirement changes were not limited to the controller career fields, but also occurred in the CDMO, AST, and RO areas. These changes resulted from the newness of the system which affected the adequacy and accuracy of the guidance concerning training standards, scheduling goals, and measures of training effectiveness. This training problem was further complicated by the fact that the experience level of the crew force was decreasing due to attrition and the lack of an established experienced manpower base to draw from. This means that crew members entering the 966's training program currently do not have the experience level of previous personnel, and training standards that were sufficient for the highly experienced

initial cadre may have to be changed or the training program restructured to account for their lack of prior experience. Once this problem is addressed and training requirements are updated, the external guidance should become sufficient and accurate for the users of the ASM.

Internally generated guidance is lacking with respect to two of the three areas, accuracy and adequacy. Not all wing organizations possess guidance concerning the ASM's operation. The documentation that could be found was incomplete or outdated for the current system. Only two squadrons had any complete instructions for scheduling, and, in one of these squadrons, the instructions were just a set of hand-me-down rules. At this point, special mention should be made of the 966th squadron's scheduling system. It was the most complete found within the wing's four squadrons. It is possible that it could be used as a model for the other squadrons to pattern their scheduling operations. The analysts could not discover any reasons why this could not be done.

With respect to timeliness, the guidance flow from the wing's command section reaches the scheduler at frequent intervals. This group interacts with the wing scheduler at the weekly and daily scheduling meetings. At these times the scheduler receives guidance and direction on his and the squadrons' scheduling efforts. However, its accuracy and adequacy is sometimes tainted by the source being removed

from the process, its product, and the problem. Overall, the command section attempts to keep abreast of the situation and offer assistance.

The internal guidance situation is being improved at this time by the development of wing operating instructions (OI's) under the direction of the chief of scheduling at the wing level. From reports within the wing, these new OI's appear to be accurate and adequate to fill the users' needs.

ASM: Resources. External resources are the key to the success of the ASM. Observation at two quarterly scheduling conferences has shown that these resources are being supplied to the ASM at the convenience of the supplier, not on the basis of the wing's needs. The problem appears to be a management philosophy problem, not one of resource limitations. Since the ASM is totally dependent upon external resources to function, these items must be provided in a timely manner and in adequate amounts. Otherwise, the ASM will never function smoothly or efficiently.

An example of this occurred when the wing attempted to get one of its quarterly tanker requests filled. SAC and its bomb wings were unable to internally coordinate the E-3A air refueling requests. The only reason offered by SAC was that the request was lost. This forced the AWACS scheduler to reaccomplish his tanker schedule three times for just one quarter. An incident like this will not occur if the

resources are provided in a timely manner when needed by the wing.

The resource allocation problem has been identified by the AWACW, solutions proposed, and documentation forwarded to HQ/TAC for action (Ref 50). However, no solution or reaction has been forthcoming.

Internally supplied resources, the wing's men and aircraft, are delivered in a timely manner and in quantities sufficient to fulfill the wing's needs. However, there is a possible problem area in the area of aircraft generation. All Air Force flying operations are dependent upon their maintenance complex for the production of aircraft to meet their needs, but a maintenance complex is dependent upon having the trained people to accomplish the tasks needed to generate airplanes. Research within the AWACW maintenance organization in the form of interviews has uncovered some problem areas. First, the maintenance force feels that it is undertrained and that the middle level leadership does not care if the training is accomplished. Second, the maintenance personnel perceive a lack of junior officer and middle level NCO supervision. A possible source of these two problems was the maintenance complex conversion from the AFM 66-1 organization to the new AFM 66-5 (Ref 43) Production Oriented Maintenance Organization (POMO) at the time of the research.

A few words are also appropriate concerning the crew force. The 966's training rate has been slowed by the lack

of resources and aircraft problems with the E-3A. This has caused the timetable for crew production to slip. This in turn has caused some crewmen to wait for periods of weeks and sometimes months before the start of their training. Some thought is needed to stopping personnel input until the present backlog of people to train is cleared. These suggestions are based on conversations with the crew force. Their lack of activity is affecting their morale, which, in turn, is impacting their decision to stay in the Air Force and the E-3A weapons system. This is a very serious situation; a similar one caused many early separations in SAC in the 1973-1976 time frame.

ASM: Commitments. The following quote will express one person's viewpoint concerning the handling of commitments.

> . . . (the wing) is trying to do too much with too little. This wing is over committed operationally, therefore the operational squadrons can not give up people to be instructors or (fill) staff positions, therefore the training squadron (and its) staff are undermanned, therefore (the 966) is unable to increase its crew production (rate) to fill shortages within the wing . . . (Catch 22) . . . .

The source of this quote is a person very familiar with the wing's operation and its scheduling effort.

Externally generated commitments appeared to the analysts to cause the most difficult problems. It seems that a number of organizations at HQ/TAC know when the activities are going to be held, their location, and the organizations that will

be participating, but these agencies never seem to tell anyone in a timely manner. To an organization like the 552nd this is a disaster, because of the many cross-command and intracommand resources the AWACW uses.

A perfect example of this is provided by the Red Flag exercises. The Red Flag planners know the dates and times that the E-3A is needed. Yet, historically, they have not presented their requests to the wing in a timely manner for incorporation into the schedules. Their commitments are input by default on open dates in the schedule, which may or may not be the desired dates for the Red Flag activities.

Red Flag and HQ/TAC are not the only sources of problems involving external commitments. ADCOM's handling of their HHQ exercise dates and TAC's own fighter wings' requirements provide other examples of commitment problems. Their common feature is that the commitment generators' needs are never communicated in time for utilization in the 552nd normal planning cycle.

In the same manner, the adequacy and accuracy of commitments are questionable. An example of this is the TAC/ADCOM alert commitment. According to interviews with people at the AWACW, HQ/TAC knew that the requirement was forthcoming and yet it still allowed the AWACW to contract for a complete quarter of resources before informing the wing that the alert commitment existed. This forced the wing schedulers to reaccomplish the entire schedule and

return the external resources. This caused a lot of hard feelings and missed training within the wing and external organization.

Internal commitments are lacking in timeliness and accuracy. Since they are dependent upon the externally generated commitments, they can only improve as the management of external commitments becomes better. This result is a further confirmation of the fact that the wing can only operate as efficiently as its external environment permits.

Under the present ASM, the people and the organizations are functioning as best they can with the information provided. Once the commitment situation is corrected, the ASM will operate much more efficiently and effectively.

ASM: Feedback. External feedback is lacking in adequacy, accuracy, and timeliness. This is due to the command's experience with the E-3A, the amounts furnished to the wing, and its timing.

TAC does not have extensive experience with a weapons system as complex as the E-3A to help generate or evaluate their particular scheduling system's needs. Today TAC operates one squadron of EC-130's and two squadrons of EC-135's. These three squadrons consist of only fourteen aircraft, none of which are as complicated as the E-3A. These circumstances do not facilitate adequate or accurate feedback.

The timing of the feedback is also poor. Formal feedback is received once a year as a result of an inspection by HQ/TAC or the TAC IG. This feedback tells how well the AWACW is operating with respect to the existing regulations and manuals. No suggestions for possible ways to improve the scheduling operation are given.

There exists a lot of internal feedback in the ASM. During the later stages of the research, it became apparent that more of it was being used to improve the system. This was especially true after the present Assistant DO for Training and Chief of Scheduling were appointed to their respective positions. The wing's sources of internal feedback are providing communications on an adequate and timely basis. Their accuracy is just now reaching a point where their feedback is becoming effective.

Comparison of the SSM and ASM. With respect to external guidance, the SSM appears to be superior to the ASM. First, the external guidance for both is timely. The guidance for both is distributed as manuals and regulations prior to the effective date, so it is readily available. However, the SSM receives guidance that is far more accurate than the ASM. Specifically, the guidance for scheduling (SACR 50-9) and the training program (SACM 51-52, Volume IV and 51-135, Volume IV) is better than that in comparable TAC publications. Experience has shown that these SAC publications are clearly

written and change very little during a training period. In contrast, the training requirements for several E-3A crew positions have changed radically with virtually no advance warning. In addition, the AWACS scheduler must consult several manuals and regulations to find all the guidance necessary to formulate a schedule. The analysts attribute this, in part, to the fact that SAC has been in operation for a longer time than the AWACW. With more experience, the TAC organization will gain more understanding of the training and scheduling needs and improve their publications. However, at this point, the SSM is better than the ASM in this respect. Finally, both systems are virtually even in the adequacy of guidance. Both lack specific decision rules for scheduling. The scheduler's judgement is used in both cases.

Internally, the ASM is better than the SSM in the area of guidance. This is due to the first criterion, timeliness. The AWACW command section interacts with the scheduler at the weekly scheduling meetings, while the BMW command personnel rarely interact with the scheduler. Both systems are lacking in accuracy and adequacy, as was discussed in the evaluation. The analysts feel that an exchange of information between the scheduling personnel and the command section would be very beneficial.

With respect to external resource flow, the SSM is superior to the ASM. SAC's resources are allocated by means of conferences at specified times. Further, the quantities

of resources to be supplied are accurately specified. The activities arranged are contracts that Headquarters SAC expects to be filled. Finally, the resources are allocated on the basis of projected wing training requirements. Experience and research have shown the SSM to be a smooth and efficient operation in this area.

In marked contrast, the ASM is deficient in timeliness, accuracy, and adequacy of resource specification. The fighter resources are supplied at times and in amounts convenient to the fighter units. The adequacy for AWACW training operations is not considered. In addition, there have been significant problems with 8th Air Force coordination of tanker requests. Specific attention has been given to these areas of external resource acquisition. At this point, no solution or action is forthcoming.

Internally, the SSM and ASM are comparable. In both instances, the existing internal resources are being supplied on a timely, accurate, and adequate basis. The analysts have noted that a potential problem exists in the AWACW maintenance area. This may require later action if the internal resource flow is impeded.

The SSM is superior to the ASM in the area of external commitment flow. The analysts have noted that the bomb wing DOTO office handles all external exercise commitments. Also, the DOX handles the alert matters. This basic plan has been

used by SAC for many years. It is a strong point in the SSM.

On the other hand, there is no AWACW organization for the coordination of external commitments. As a result, exercise commitments are not passed to the 552nd schedulers in a timely manner. Red Flag, a major commitment generator, does not even send a representative to the Quarterly E-3A Scheduling Conference. The agencies that do attend frequently do not provide their exercise requests until the dates arise in the proceedings. In addition, alert commitments are not passed in time for inclusion in the quarterly scheduling flow. These situations cause a lot of extra work and expenditure of time to reaccomplish the schedule. This creates a greater potential for mistakes on the part of the AWACS scheduler. The external commitment flow is definitely not timely, not accurate, and not adequate. This is a serious flaw in the ASM.

Internal commitments flow to the SSM is better than in the ASM. The required information is passed to the SAC scheduler at regular times. It is continually updated to help the scheduling flow. As was pointed out, the flow in the ASM is hindered by external factors.

In the area of external feedback, both systems are lacking. The ORI's (SAC and TAC) and the staff assistance visits (SAC) only show unfavorable trends. However, the

overall view of these evaluations and the lack of suggestions for improvement do not help to create a better situation. This is a big problem for both, one that could be avoided by expanded feedback.

Internally, the ASM feedback flow is somewhat better than that of the SSM. People at a wing level are involved at the 552nd, not only in the planning, but also in the execution of the schedule. This interaction is a definite aid to the scheduling effort.

Question Two: Flexibility to Change During the Planning Phase

To answer Question Two, each of the systems was evaluated for flexibility to change during the planning phase. The analysts feel that flexibility is an essential feature for timely and efficient scheduling.

SSM: Flexibility. The writers feel that the SSM is quite capable of handling changes that occur during the planning phase. SACR 50-9 specifies that each schedule is a refinement of some previous one (Ref 13:3-2-3-3). This implies that changes are to be expected as the scheduler formulates the various plans. Experience has shown this to be true.

ASM: Flexibility. If a change occurs during the ASM's planning stages, either from new guidance, commitments, or through external resources the scheduling system is capable

of handling the change. The complexity and detail of the change will dictate the ease with which it is input into the schedule. The ASM's monthly meetings allow an easy input of changes from all levels concerned with the model.

A good example of this capability was observed by the researchers when TAC notified the wing of its alert commitment. The wing, through its monthly scheduling meeting, was able to make the necessary adjustments to their schedules even though it affected over eighty sorties.

As demonstrated in the text, each of the wing's schedules is a refinement of the previous one. This implies that changes are expected as the scheduler formulates the plans and they grow towards execution. At all levels within the wing this is true. So, with regard to Question Two, the writers feel that the present ASM is capable of handling changes without any modifications to the present system.

Comparison of the SSM and ASM. When comparing the two models with respect to Question Two, the authors feel that both systems are working efficiently and can handle changes. Both systems use a moving "Quarter System," whereby each iteration of the schedule, from the quarterly to the daily in the case of the ASM, and from the MOP to the weekly in the SSM's case, is just a refined version of the previous one. The information in each iteration is more detailed; using this method allows for greater flexibility by the

scheduler to accomodate changes during the planning phase of the schedule.

Question Three: Does Guidance Force Good Planning?

To answer Question Three, each of the models was evaluated in regard to the guidance supplied for the use of the system. The analysts feel that structured guidance is necessary to insure good planning.

The SSM's Position. When SSM was examined in accordance with Question Three, it was found that the guidance did force systematic and logical planning. The information in SACR 50-9 gives a scheduling flow based on refined inputs. Further, specific time guidelines are specified for processing each of the schedules (see Refs 13 and 38). It has been previously noted that specific decision rules would help the mission developer. Even without these, the planning has been noted to be systematic and logical.

The ASM's Position. When ASM was examined in accordance with Question Three, it was found that the guidance supplied to the users of the model also forced systematic and logical planning. The information in 552 AWACWR 60-5 gives a scheduling flow based on specific time guidelines. The Joint, Air Force, TAC, and SAC regulations also have suspense dates that the scheduler must abide by in order to use or schedule these resources. As already stated, within these

publications there are no decision rules for tradeoffs on resources or manpower, however, even without these, the planning observed by the researchers has been systematic and logical.

Comparison of the SSM and the ASM. The author's research indicates that the operators guidance for both models does force systematic and logical planning. As noted, both models do not have decision rules to assist the scheduler in making tradeoff decisions between resources, people, and missions. But despite these shortcomings both systems are supplied with adequate guidance to force logical and systematic planning.

Question Four: Timely Rescheduling

With respect to Question Four, each of the systems was evaluated from the following perspective. Once the schedule is in the execution phase, that time from the end of mission planning to a sorties final landing, does the model concerned allow for timely rescheduling?

SSM: Rescheduling. The analysts found that the SSM allows timely rescheduling during the execution phase. To reschedule events, the scheduler does several things. First, he notes that something has changed (feedback). Then he determines the resources affected and procures new ones, if possible. Finally, he adjusts the schedule and passes the new one to the crew.

If this occurs prior to flight, the coordination of resources is accomplished by telephone. The mission developer usually deals with SAC agencies for resources such as RBS times. The new schedule is given to the crew when they arrive for flight duty, usually two to three hours before takeoff.

Inflight changes are made in much the same way. Again, the scheduler coordinates the new resources by telephone. The information is then relayed to the crew by radio.

The analysts have observed the SSM in actual operation. They feel that its ability to reschedule events is a strong point.

ASM: Rescheduling. When evaluating the ASM with respect to Question Four, the analysts found that the model did not allow for timely rescheduling during the execution phase. To reschedule events, the scheduler first must be aware of the need for a change. He next determines the resources affected and procures new ones, if needed, or adjusts those he has to compensate for the change. Only as a last resort will the scheduler recommend the cancellation of a mission.

If a change occurs prior to the flight, the coordination of resources is accomplished by telephone. The scheduler must deal with not only the agency(ies) representing the resource(s), but also the squadron responsible for the mission. This entails much effort and phone calling. Also,

there are certain briefings that must be accomplished between the aircraft crew and the resource crew(s) prior to performing certain types of maneuvers. Constraints of this nature effect the wing's capability to make last minute changes.

These constraints, coupled with the fact that the wing is located in one time zone and the resources, for the most part, are located in another, also complicate the problem. A final adverse factor is that the fighter resources do not mission plan the day prior to a flight. This means that there is usually no one at the resource organization for coordination. The last problem has arisen many times, and has almost caused a number of crew rest violations on the part of the E-3A crews (Ref 1:7-1).

Once a decision is made concerning a change it is relayed to the affected organization as outlined in Chapter V. It then becomes the responsibility of the squadrons and their aircrews to make all the briefings and paperwork out correctly to insure the mission is completed in a safe and orderly manner.

If a change occurs inflight, it is handled in much the same manner. Again, the scheduler coordinates the new resources by telephone and relays the information to the crew via radio.

The analysts have observed the ASM and they feel that this is one of their weak areas. However, this weakness

stems from the wing's dependence upon external resources and not upon the organization itself.

Comparison of the SSM and ASM. When comparing the SSM to the ASM using Question Four as the standard, the ASM was found lacking in both the ground and inflight environment. The SSM's capabilities for rescheduling during the execution phase far outclass those of the ASM. The ASM's shortcomings originate from the fact that the wing is not dealing with resources totally dedicated for their use, as is the case in the SSM. The 552nd deals with resources not only outside their own wing but also outside their NAF and command. This could lead to conflicts in purposes and interests. Finally, the problem of two different mission planning philosophies also degrades the ASM's capabilities. As pointed out in the text, the manuals have constraints which must be followed in order to complete mission planning. The fighter units follow one method, that of mission planning on the day of the flight, and the AWACS another, that of mission planning on the day prior. This difference has lead to incomplete AWACS mission planning and briefings, as well as crew rest violations. The sum total of these facts impacts heavily on the ASM's reaction capability during the schedule's execution phase.

Question Five: Duplication of Effort

Question Five's criterion is duplication of effort. Are there any organizations involved in the scheduling model that are doing the same job, or are there an insufficient number to complete all the tasks required to operate the system?

SSM: Duplication. In the SSM only one organization is involved in the scheduling effort, as required by SACR 50-9 (Ref 13:1-1). As a result, there is no duplication of effort. This facilitates coordination with both external and internal agencies. The writers feel that these features make the SSM particularly effective for scheduling.

ASM: Duplication. In the ASM there are two levels involved in the scheduling process performing the same functions. One level assigns the crewmen for specific sorties and the other contracts for the resources for the sorties. In addition, the data tracking function, mission analysis, and the ground and simulator scheduling efforts are duplicated at both the wing and squadron levels of the ASM. The researchers feel this is a duplication of effort. A consolidation of effort would greatly improve the ASM.

Comparison of the SSM and ASM. The writers feel that the SSM is more effective than the ASM in this area. In SAC, the entire scheduling effort is concentrated in one office.

Likewise, other functions such as data tracking and flight records are accomplished by single, wing-level agencies. Experience has shown this to be both efficient and effective in operation.

In contrast, the ASM has two levels involved in the scheduling effort. The wing scheduler procures external resources and constructs missions. The squadron scheduler simply allocates personnel to these activities. From interviews and observation, it is apparent that the wing scheduler does most of the work. The extra level adds time to the coordination effort and increases the volume of communications necessary to formulate and execute the schedules. In addition, functions such as data tracking and mission analysis are done at both squadron and wing level. The duplication of work causes many man-hours of wasted effort.

Recommendations

After the evaluation and comparison, the writers developed twenty-eight separate items for recommended action. These were condensed into six separate topical areas; guidance, resources, commitments, feedback, operational scheduling, and the schedule's execution phase. The recommendations for the six areas will now be presented.

Guidance. The analysts recommend a consolidation of scheduling guidance. TAC should develop a regulation similar to SACR 50-9 which would contain all needed guidance for the

formulation of required schedules and specify time guidelines for required actions. This publication could cover all TAC units and should include decision rules for scheduling.

Resources. With respect to resources, the analysts recommend three changes to improve the acquisition of external resources. First, the command guidance should be altered to give the E-3A priority for resources. Second, the appropriate TAC 51-XX series training manuals should be changed to require all fighters to operate with the E-3A. This will make more resources available for AWACS aircrew training. Third, the appropriate NAF AWACS schedulers should be given the authority to commit TAC, ANG, and AFREFS fighters for E-3A training missions as is true for the ADCOM AWACS schedulers. Finally, the 966th training sorties should become firm command requirements. This will ensure that the E-3A training flow is maintained in an orderly manner.

Commitments. The analysts have three recommendations in this area. First, establish a single manager for all AWACW commitments. This office should be located at Tinker Air Force Base and should have command-wide responsibilities and capabilities. All commitment requests should be routed through this agency enroute to the AWACW scheduler. Second, these requests should have a standardized format. This

format should include the number of AWACS sorties required, the dates, any special information concerning the E-3A, an appropriate suspense date, and any other information deemed necessary by the wing to make a decision on whether or not to commit forces against a request. Finally, this agency should not honor requests that are not presented in accordance with the established rules. Late or inaccurate requests hinder the scheduler and make inefficient scheduling more likely to occur. These improvements will help to alleviate a severe problem.

Feedback. In this area the authors recommend three changes. First, make use of the "in-house" experience that exists today in the wing. Since the wing is made up of officers and NCO's from many varied backgrounds, this group should be able to offer a solution to the scheduling situation which could possibly be the best of all the Air Force systems. Second, both TAC and AWACW should put more constructive comments in their inspection and staff assistance reports. Today's evaluation systems offer enough negative feedback. More constructive and factual feedback is needed. This is essential to the scheduling system if it is to grow and operate more efficiently. Finally, the wing and TAC should ask other commands for assistance in solving their scheduling problem. The wing has made some effort in this area by sending representatives to other command's bases to

review their scheduling systems. TAC is the sole operator of the E-3A, but, because the system uses so many other commands' resources, it might be wise for TAC and the AWACW to interact with other commands on a one-to-one basis with regard to the E-3A scheduling system. This would improve the rapport between commands, offer a forum for feedback, and gave ideas on improving the entire command's scheduling system.

Operational Scheduling. The next area is that of the wing's present scheduling organizational structure. As pointed out in the text, there is a duplication of effort that could be removed. It is recommended that the wing's entire operational scheduling effort be consolidated. It is important to note the words "operational scheduling." This is relevant because the analysts are not advocating the assimilation of the 966th's scheduling system at this time. Due to that squadron's unique mission, requirements, size, and time constraints, it would be inefficient and perhaps impossible to consolidate them into a centralized scheduling system.

By consolidating all the operational scheduling into one office, communication problems would be minimized, one level of duplication of effort would be eliminated, and allowance made for a central location from which to manage all the wing's operational resources, centralizing the data management functions required to schedule aircrews.

To implement this change, the wing may need to add a few more people to the wing scheduling staff. These personnel gains would be offset by a decrease in the number of squadron personnel who are presently involved in scheduling. These people could be put to work at other tasks which could be more productive for the squadron and, in turn, for the wing.

Schedule Execution Phase. The last area for recommended change involves the ASM's capabilities during the execution phase of scheduling. As stated, this area is dependent upon the guidance on which the scheduling system is based, the resources the process needs to function, how commitments are placed upon the system, and the organizational structure within which it operates.

The researchers recommend the incorporation of the previously mentioned changes to improve the ASM's scheduling execution phase capability. Once the ASM's guidance is changed and disseminated, those constraints and needs of the model will be known to its users. These facts will impact upon the resource suppliers and commitment generators by forcing them to better plan and utilize the AWACS. These proposed changes coupled with suggested organizational realignment will further improve the ASM.

This concludes Chapter VI. The final chapter summarizes the thesis, recommends areas for future study, and closes with a few additional comments on the ASM.

VII. Conclusions and Suggested Further Study

In this final chapter the analysts will present their conclusions from this study effort and recommend some areas for further study.

Conclusions

The overall conclusion from this thesis is that some changes must take place in TAC if the E-3A is to be utilized to its full effectiveness. The ones the writers feel are most important to the 552nd AWACW scheduling system were presented in Chapter VI as recommendations. It should be apparent that these are broad in scope, will take time to implement, and will impact an entire command, if not the entire United States Air Force.

In Chapter I the authors noted that command level problems existed in philosophy, education, and utilization. They conclude that the recommended courses of action will help to correct these problems.

Philosophy. First, the recommended changes will help to standardize and improve scheduling, resource acquisition, and exercise requests. This philosophy change must originate from the top management levels of the Tactical Air Command and be disseminated to all lower levels of the command. The

E-3A is a complex aircraft with many requirements. As such, it requires structured scheduling guidance, priority for external resources, and timely information. Improved feedback and the use of the experience of others will help to improve the situation. All of these areas can only change with philosophy.

Education. Second, the recommended changes will help to educate all levels of TAC in the many capabilities of the E-3A.

Currently, the Sentry has many capabilities and possible uses. If all TAC fighter units are required to work with the E-3A, they will gain an appreciation for the current uses and may even be able to suggest new ones for the AWACS. This would be beneficial to the Air Force.

Utilization. Finally, the recommended changes will improve the utilization of the E-3A. The more aircraft that operate with the AWACS, the higher the utilization rate of the entire weapons system. As previously stated, this will help to educate the users. In addition, it will enable the E-3A crews to upgrade on a timely basis and maintain a high state of combat readiness. As stated by Niccolo Machiavelli in 1513:

> The principal foundations of all states are good laws and good arms; and there cannot be good laws where there are not good arms.

The Sentry is a "good arm." It should be utilized accordingly.

Suggested Further Study

The authors have noted that there are three areas that could be aided by future study. This thesis will end with a few words about each of them.

First, a set of recommendations could be made to improve SAC's aircraft scheduling system. The last work in this area was accomplished by Berman (Ref 7) in 1975. The analysts feel that this study would help to update the SSM.

Second, an extensive study should be made to determine the relevant decision rules for effective scheduling of aircraft such as the B-52, KC-135, and E-3A. These would serve to improve the many aspects of the scheduling operation. The 552nd AWACW Operations Analysis personnel have expressed a particular desire to see some work done in this area.

Finally, some thought should be given to the use of computer methods to aid the scheduler. The analysts feel that a computer program to track information for each sortie would help to reduce the time needed to schedule. Today, the 552nd has taken some steps in this direction but more time, money, and manpower is needed to fully integrate the computer as a useful tool into the scheduling effort.

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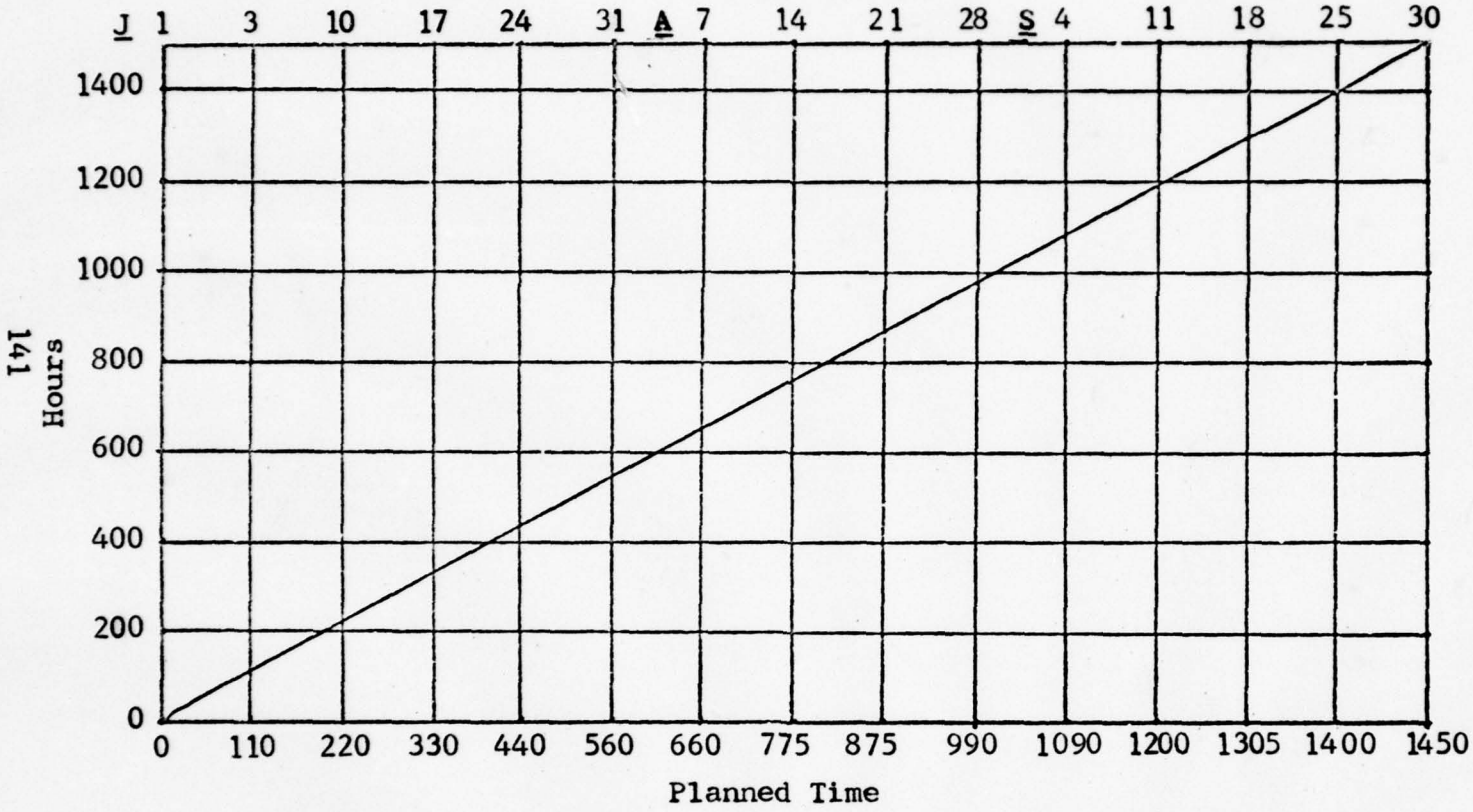
Appendix A

Sample NAF Flying Hours Allocation and RBS Allocation



Flying Hour Allocation for Jul-Sep 1977

Sample RBS Allocation

Wing	Site	Time
005	WDR	2100
005	WDR	2130
005	WDR	2200
005	BAY	1945
005	BAY	2015
005	BAY	2045
005	LAJ	2000
005	LAJ	2030

Appendix B

Sample Wing Level Inputs

Sample Gunfighter Lineup

Group I	Group II	Group III
S-01	R-05	R-14
S-02	R-06	R-15
S-03	R-07	R-17
S-04	R-08	R-22
E-19	R-09	
	R-10	
	R-11	
	R-12	
	E-16	
	E-18	
	R-20	
	R-21	
	R-23	
(Minimum of 1)	(Any 3)	(1 Only)

Sample Evaluation Schedule

PERIOD: FEB 77

AFM 60-1 AND SACM 60-4 SCHEDULE

CREW POS	NAME	CREW NO.	PROF CHECK EXPIRES	INST CHECK EXPIRES	SIMUL CHECK EXPIRES	FLIGHT CHECK SCHEDULED	SIMUL CHECK SCHEDULED	BACKUP FLIGHT	FLIGHT CHECK EVALUATOR			REMARKS	E. P. EXAM	OTHER STAN EVAL EXAMS
CP	DUNN	S-03	FEB	FEB									OCT	OCT
P	HOEKSTRA	R-08	FEB	FEB									OCT	OCT
N	OSTFELD	R-21	FEB									DATE MAY CHANGE	OCT	OCT
RN	RODDEN	SP	FEB									PALACE CHASE	OCT	OCT
RN	SCHEURS	R-16	FEB										OCT	OCT
IN	TEEPELL	R-09	FEB										OCT	OCT
EW	THALKEN	R-20	FEB										OCT	OCT

15AF FORM JUN 71 46 REVISED

Sample Leave Schedule

Crew	Dates
R-09	1-14 Aug
E-19	9-21 Aug
R-06	14-28 Aug

Sample Crew Change Letter

1 Aug 1977

FROM: 23BMS/CC

SUBJECT: Proposed Crew Change 77-8 (Bomber)

TO: 5BMW/CC/DO/DOTT/DOTG/DOTP/DOTN/DOTF/DOV/DOX/IN

1. Reference Proposed Crew Change 77-7, Revised July changes:

   a. Additions: None

   b. Deletions: None

   c. Amendments; None

2. Revised August Changes:

NAME	POSITION	DATE	REPORT
Capt Wynne	P R-09 to P Spare	1 Aug	OER
Capt Roth	P R-07 to P R-09	1 Aug	NO
Capt Herrick	P E-24 to P R-07	1 Aug	NO
Lt Frazier	CP R-09 to CP Spare	1 Aug	OER
Capt Slemp	XCP R-07 to CP R-09	1 Aug	NO
Lt Forrester	XCP E-24 to XCP R-07	1 Aug	NO
Maj Schwertner	RN R-07 to RN Spare	1 Aug	OER
Capt Ebensperger	RN E-24 to RN R-07	1 Aug	NO
Capt Allain	NN R-07 to NN Spare	1 Aug	OER
Lt Oetker	NN E-24 to NN R-07	1 Aug	NO
Lt Salisbury	EW R-07 to EW Spare	1 Aug	OER
Capt Murdock	EW E-24 to EW R-07	1 Aug	NO

Sample Sortie Contract

FROM: 5BMW/DOTT

SUBJECT: November 1977 Operations Sortie Requirements

TO: 5BMW/MA
5BMW/MAMX
IN TURN

1. The following 5BMW Operations Sortie Requirements are for November 1977.

2. The tentative maintenance sortie proposal is due to the 5BMW/DOTT not later than 12 October 1977 in accordance with SACR 50-9. A firm sortie contract should be reached by 19 October 1977. The final joint maintenance/operations sortie contract will be signed at the monthly maintenance/operations meeting on 19 October 1977 in compliance with SACR 50-9/60-9.

3. The following sortie requirements are based upon SACM 51-52/135, FY 78-1 sortie requirements of nine sorties per crew member for 22 B-52 crews and 24 KC-135 crews. This produces total quarterly requirements of 198 B-52 sorties and 216 KC-135 sorties for the quarter. Flying days available for the quarter are October - 19; November - 20; December - 16. The planned operations sortie requests will be for 69 B-52 sorties for October; 75 for November and 54 for December. The November and December requests will be adjusted to compensate for deviations from the sorties actually flown during the previous month. The KC-135 sortie requests will be adjusted to provide sorties to cover higher headquarters taskings and organic B-52 refuelings.

4. B-52 sortie requirements are as follows:

DAY	SORTIES	TYPE	T/O	DURATION	REMARKS	LOW LEVEL	CREW
T-1	4	ICTS	1100	9.0	A/R W/906/FTR	OB-24	S-04
		ICTS	1200	8.7	A/R W/906	OB-28	E-08
		EPTS	2145	8.3	A/R W/906	OB-10	S-01
		EPTS	2245	7.5	A/R W/906	OB-54	R-05
W-2	5	ICTS	*A/R	6.0	HHD Red Flag	-----	R-10
		ICTS	A/R	8.0	HHD Red Flag	-----	R-14
		ICTS	A/R	8.0	HHD Red Flag	-----	R-15
		ICTS	1035	8.8	A/R W/93	OB-1	E-12
		ICTS	2245	7.5	A/R W/906	OB-54	S-03

Appendix C

Sample Schedules from the

Monthly Operations Plan

Sample Working Schedule

MONTHLY COMBAT CREW TRAINING SCHEDULE

ORGANIZATION

23rd BOMB SQ

LEGEND: *Use of symbols shown are mandatory. Additional symbols may be added to meet unit requirements.*

A - Alert
O - CCRR
M - Mission Plan
L - Leave
G - Ground Training
S - Simulator
T - Temporary Duty
D - Duty Not Involving Flight
F - Fly Day
F_n - Fly Night
F_s - Standardization Check
F_h - Fly Higher H.Q.

CREW NO		CREW POSN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
S-01	KOPP																																
S-02	DENNIS		T(2)																													L	
S-03	HAGEMANN																																
S-04	MONBECK																																
R-05	WITTNEBERT																																
E-06	BLACKLEDGE																																
R-07	ROTH																					L											
E-08	HOEKSTRA																																
R-09	ESTOCK																																
R-10	STRATMAN																																
R-11	MILLER																																
E-12	JOHNSON																																
R-14	SAUNDERS																																
R-15	DEMAND																																
R-16	HORTON																																
R-17	REINERT													L																			
R-18	MYERS																																
R-19	VERMILLION																																
R-20	POE																					SI											
R-21	SPRAGUE																																
R-22	RALL																																
R-23	BROCKUNIER																					L											
R-24	HERRICK		T(2)																				SI										

SAC FORM JUL 75 681 REVISED

Sample Semi-Final Schedule

MONTHLY COMBAT CREW TRAINING SCHEDULE

ORGANIZATION

23rd BOMB SQ

LEGEND: *Use of symbols shown are mandatory. Additional symbols may be added to meet unit requirements.*

A - Alert
O - CCRR
M - Mission Plan
L - Leave
G - Ground Training
S - Simulator
T - Temporary Duty
D - Duty Not Involving Flight
F - Fly Day
F_n - Fly Night
F_s - Standardization Check
F_h - Fly Higher H.Q.

CREW NO		CREW POSN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
S-01	KOPP																			A								O	O	O			
S-02	DENNIS		A			O	O	O																									
S-03	HAGEMANN													L																	SI		
S-04	MONBECK																																
R-05	WITTNEBERT																			A								O	O	O			
E-06	BLACKLEDGE					A							O	O	O																		
R-07	ROTH												A							O	O	O											
E-08	HOEKSTRA							SI					A							O	O	O											
R-09	ESTOCK		A			O	O	O												A								O	O	O			
R-10	STRATMAN					A							O	O	O																		
R-11	MILLER					A							O	O	O													A					
E-12	JOHNSON														SI													A					
R-14	SAUNDERS												A							O	O	O											
R-15	DEMAND												A							O	O	O											
R-16	HORTON																			A								O	O	O			
R-17	REINERT					A							O	O	O																		
R-18	MYERS																											A					
R-19	VERMILLION												A							O	O	O											
R-20	POE		A			O	O	O																							L		
R-21	SPRAGUE		A			O	O	O																				A					
R-22	RALL								L																						SI		
R-23	BROCKUNIER					A							O	O	O													A					
R-24	HERRICK		A			O	O	O												A								O	O	O			

SAC FORM JUL 75 681 REVISED

Sample Final Schedules

MONTHLY COMBAT CREW TRAINING SCHEDULE

ORGANIZATION

23rd BOMB SQ

LEGEND: *Use of symbols shown are mandatory. Additional symbols may be added to meet unit requirements.*

A - Alert
O - CCRR
M - Mission Plan
L - Leave
G - Ground Training
S - Simulator
T - Temporary Duty
D - Duty Not Involving Flight
F - Fly Day
F_n - Fly Night
F_s - Standardization Check
F_h - Fly Higher H.Q.

CREW NO		CREW POSN
S-01	KOPP	
S-02	DENNIS	
S-03	HAGEMANN	
S-04	MONBECK	
R-05	WITTNEBERT	
E-06	BLACKLEDGE	
R-07	ROTH	
E-08	HOEKSTRA	
R-09	ESTOCK	
R-10	STRATMAN	
R-11	BEAUMONT/MILLER	
E-12	JOHNSON	
R-14	SAUNDERS	
R-15	DEMAND	
R-16	HORTON	
R-17	REINERT	
R-18	MYERS	
R-19	VERMILLION	
R-20	POE	
R-21	SPRAGUE	
R-22	RALL	
R-23	BROCKUNIER	
R-24	HERRICK	

SAC FORM JUL 75 681 REVISED

MONTHLY COMBAT CREW TRAINING SCHEDULE

ORGANIZATION

23rd BOMB SQ

LEGEND: *Use of symbols shown are mandatory. Additional symbols may be added to meet unit requirements.*

A - Alert
O - CCRR
M - Mission Plan
L - Leave
G - Ground Training
S - Simulator
T - Temporary Duty
D - Duty Not Involving Flight
F - Fly Day
F_n - Fly Night
F_s - Standardization Check
F_h - Fly Higher H.Q.

CREW NO		CREW POSN	1	4	5	6	7	8	12	13	14	15	18	19	20	21	22	26	27	28	29
S-01	KOPP	ALL		M	F_n	-				M	F					A	—	—	—	O	O O °
		P																			
		CP																			
		RN																			
		N																			
		EW																			
		G																			
S-02	DENNIS	ALL			M	F		L	—	—	—	—	—	—	—	—	SI	M	F	A	— —
		P																			
		CP	T	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— —
		RN																			
		N											T	—	—	—	—	—	—	—	— —
		EW																			
		G																			
S-03	HAGEMANN	ALL	F				A	—	—	—	O	O O °			M	F_n	-					
		P											T-SI								
		CP											T-SI								
		RN											G	G				T	—	—	SI
		N	SI																		
		EW											GA								
		G																			

SAC FORM 681 JUL 75 REVISED

Appendix D

Mission Ready Flying Training Requirements

CHAPTER 6

MISSION–READY FLYING TRAINING REQUIREMENTS

CODE	EVENT	MONTHS AVAILABLE 1	2	3	FREQUENCY NO./DAYS
6–1. CREW:					
D01	EWO Profile Training Sortie	0	1	1	
D02	Integral Crew training Sortie	2	3	4	
D03	Command Directed Training Sortie	2	4	6	
6–2. PILOT:					
$B36	Low Level Bombing Exercise				1/45
I09	Nonprecision Approach	1	2	3	
I10	Missed Approach	1	2	3	
*I14	Instrument Approach				1–45
I23	Precision Approach	1	3	5	
†N09	TA/EVS Navigation Leg	1	2	3	
N15	Low Altitude Navigation Leg	1	2	3	
N48	J–4 Compass Entry–Exit Exercise	0	1	1	
P02	Sortie	3	6	9	
*P08	Takeoff	1	2	3	1/45
$P09	Heavyweight Takeoff (D only)				1/365
*P13	Landing	1	2	3	1/45
P16	Landing (Night)	0	1	1	
*P17	Instructor Duties				1/60
P22	Cell Formation				1/180
$P24	MITO				1/365
P27	Airborne Radar Approach	0	1	2	
P70	Pilot Proficiency Exercise				1/180

CODE	EVENT	MONTHS AVAILABLE 1	2	3	FREQUENCY NO./DAYS
*R01	Air Refueling (Day/Night)	1	2	4	1/45
R04	Alternate Rendezvous	0	1	1	
R05	Air Refueling (Night)	0	1	1	
R08	Heavyweight Air Refueling				1/365
†T29	TA PUP	0	1	2	
†T33	TA/EVS Bomb Run	1	1	2	
T66	Air Refueling, Tanker Autopilot Off	0	1	1	
T80	High Speed Bomb Run	0	1	2	
6–3. COPILOT:					
$B36	Low Level Bombing Exercise				1/45
I09	Nonprecision Approach	1	2	3	
I10	Missed Approach	1	2	3	
*I14	Instrument Approach				1/45
I23	Precision Approach	1	3	5	
†N09	TA/EVS Navigation Leg	1	2	3	
N15	Low Altitude Navigation Leg	1	2	3	
P02	Sortie	3	6	9	
P08	Takeoff	1	2	2	
*P13	Landing	1	2	3	1/45
P16	Landing (Night)	0	1	1	
P70	Pilot Proficiency Exercise				1/180
†T33	TA/EVS Bomb Run	1	1	2	
T80	High Speed Bomb Run	0	1	2	

CODE	EVENT	MONTHS AVAILABLE 1	2	3	FREQUENCY NO./DAYS
6–4. RADAR NAVIGATOR:					
B01	Low Altitude Multiple Release Bomb Run	3	6	9	
B08	Double Release High Altitude	0	1	1	
B25	Multiple Low Altitude Fixed Angle Bomb Run	1	2	3	
$B36	Low Level Bombing Exercise				1/45
C04	AGM–69 Run (High Altitude)	0	1	1	
C05	Dual AGM–69 Run	0	1	2	
†N09	TA/EVS Navigation Leg	1	2	3	
N50	Low Altitude Doppler Out Exercise	0	1	1	
*P02	Sortie	3	6	9	1/60
*P17	Instructor Duties				1/60
P22	Cell Formation				1/180
P27	Airborne Radar Approach	0	1	2	
R03	Electronic Rendezvous	1	2	3	
R20	On Course Rendezvous	0	1	1	
†T33	TA/EVS Bomb Run	1	1	2	
T80	High Speed Bomb Run	0	1	2	
6–5. NAVIGATOR:					
B01	Low Altitude Multiple Release Bomb Run	3	6	9	
B08	Double Release High Altitude	0	1	1	
B25	Multiple Low Altitude Fixed Angle Bomb Run	1	2	3	
$B36	Low Level Bombing Exercise				1/45

CODE	EVENT	MONTHS AVAILABLE 1	2	3	FREQUENCY NO./DAYS
C04	AGM–69 Run (High Altitude)	0	1	1	
C05	Dual AGM–69 Run	0	1	2	
†N09	TA/EVS Navigation Leg	1	2	3	
N12	Celestial Control Time Exercise	1	1	1	
N25	DR Nav Leg	0	1	1	
N35	Basic Night Celestial Navigation Leg (Grid/True)	0	1	1	
N48	J–4 Compass Entry–Exit Exercise	0	1	1	
N50	Low Altitude Doppler Out Exercise	0	1	1	
$N51	Celestial Navigation Leg	1	2	3	1/45
*P02	Sortie	3	6	9	1/60
*P17	Instructor Duties				1/60
R03	Electronic Rendezvous	1	2	3	
R20	On Course Rendezvous	0	1	1	
†T33	TA/EVS Bomb Run	1	1	2	
T80	High Speed Bomb Run	0	1	2	
6–6.	ELECTRONIC WARFARE OFFICER:				
$E01	RBS ECM Run	3	7	10	1/45
E04	Optional Defense Run (N/A 43SW)	0	1	2	
E05	Dual Defense Run (43SW Only)	0	1	2	
E34	Proficiency Exercise	2	4	6	
†F01	Fighter Intercept Exercise				1/180
*P02	Sortie	3	6	9	1/60

CODE	EVENT	MONTHS AVAILABLE 1	2	3	FREQUENCY NO. /DAYS
*P17	Instructor Duties				1/60
T16	Simulated Equipment Malfunction Run	0	1	2	
6–7. GUNNER:					
†F01	Fighter Intercept Exercise	1	1	1	1/180
F02	Defense Coordination Exercise	1	2	3	
$F03	EWO Profile Exercise	1	2	3	1/45
F05	Flight Evaluator Operator	0	1	1	
*P02	Sortie	3	6	9	1/60
*P17	Instructor Duties				1/60

NOTE: F01 requirement (Gunner) covers a 4 month training period (Jan–Apr, May–Aug, Sep–Dec).

* Currency Events.

$ Readiness Events.

† 43SW will accomplish as many of these events as possible.

Appendix E

Mission Composition of an M-A and M-T AWACW Sortie

E-3A M-A Training Sortie

12-18 Fighter or Target Sorties Minimum
3 Hours Useful Activity Minimum
Training Events
- Intercepts-Classic ADCOM/Night Tactical
- Non-Maneuvering Targets
- Fighter Air-to-Air Refuelings
- One-v-One or Two-v-One Fighter Attacks
- Fox Band ECM
- TADIL A Interface

Operate under Joint Manual 55-200 and fragged in accordance with TACR/ADCOMR 51-8.

E-3A M-T Training Sortie

12-18 Fighter or Target Sorties Minimum
3 Hours Useful Activity Minimum
Training Events
- Aerial Combat Tactics/Dissimiliar Air Combat Tactics
- No Enemy Aerial Combat Tactics
- Fighter Air-to-Air Refuelings
- Close Air Support/DICT
- Forward Air Controller Rendezvous
- Fox Band ECM
- TADIL A Interface

Operate under Joint Manual 55-200 and fragged in accordance with TACR/ADCOMR 51-8.

Source: 552 AWACW Briefing to October 1978 Fighter Resource Conference.

Appendix F

Organizations That Attended the Two E-3A Fighter Scheduling Conferences

Meeting Date:	12-13 July 1978	5-6 October 1978
Attendees:		
	22 NORAD Region	20 NORAD Region
	Air Command HQ	21 NORAD Region
	24 NORAD Region	22 NORAD Region
	552 AWACW	24 NORAD Region
	9AF/DOYOX	25 NORAD Region
	507 TAIRCW	26 NORAD Region
	12 AF/DOCW	HQ/TAC DOA
	474 TFW	552 AWACW
	35 TFW	9 AF
	388 TFW	12 AF
	25 NORAD Region	35 TFW
	20 NORAD Region	449 TFW
	1 TFW	388 TFW
	CINCLANT/N 338	474 TFW
	CAEW-12	Air Command HQ
	26 NORAD Region	1 TFW
	TAC/DOA	
	ADCOM/DOCA	
	21 NORAD Region	

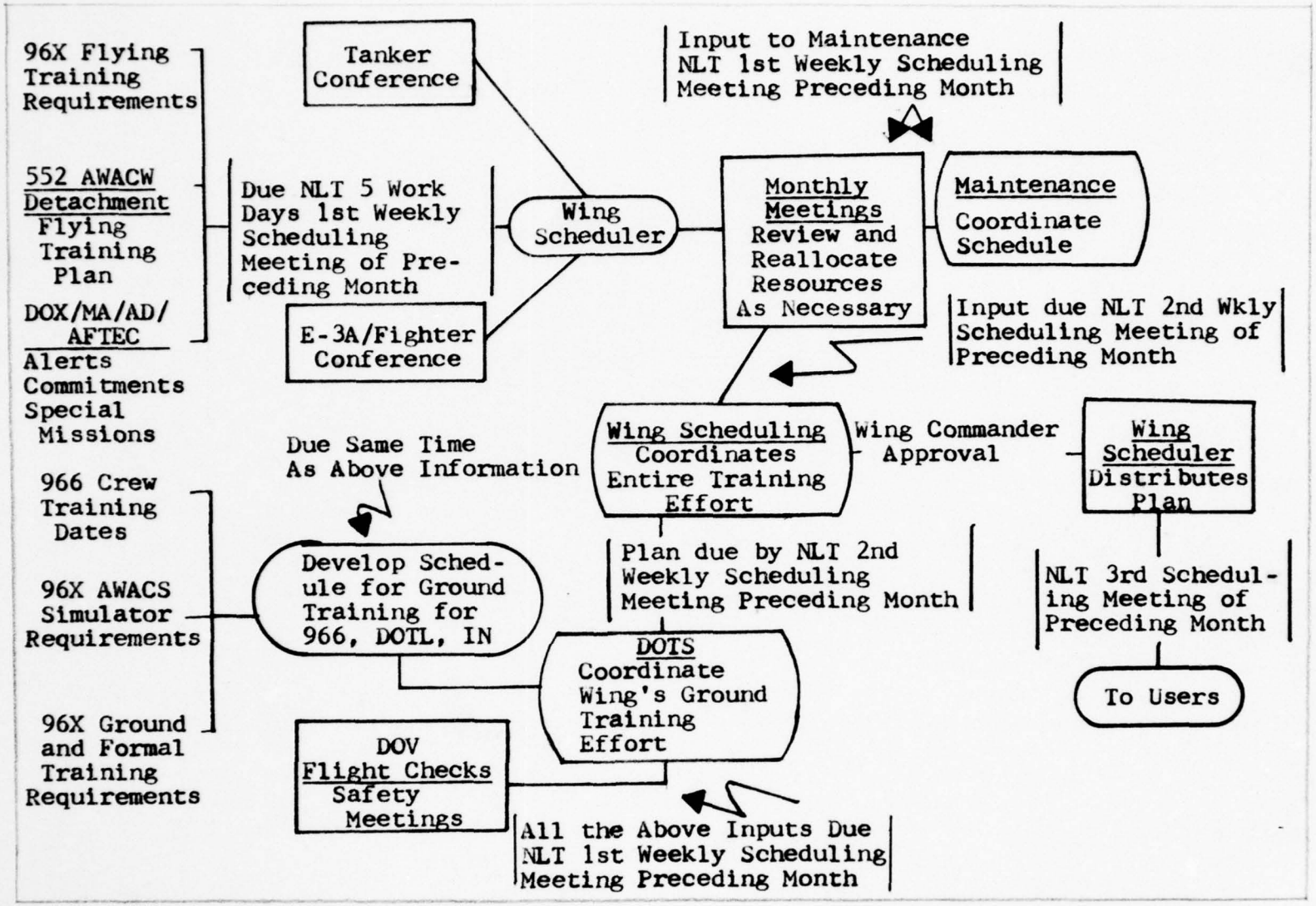
SOURCE: Attendance Rosters at each Meeting.

Appendix G

Flow Diagrams of AWACW Scheduling System

Monthly and Quarterly Scheduling

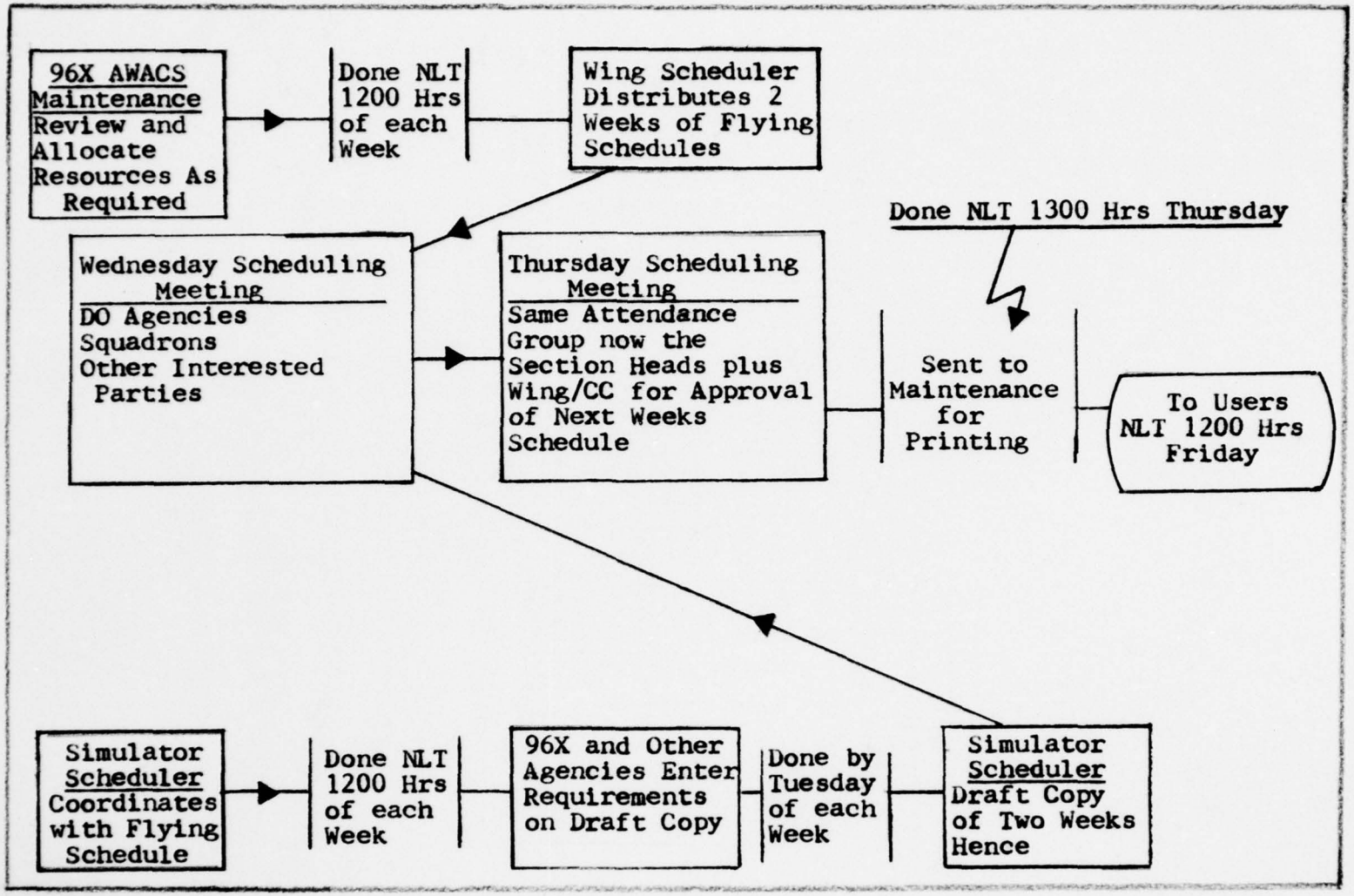
Process at the 552nd AWACW



Monthly and Quarterly Scheduling Process in the 552nd AWACW

Scheduling Flow of the Weekly

Process Used by the 552nd AWACW



AWACW Weekly Scheduling Flow

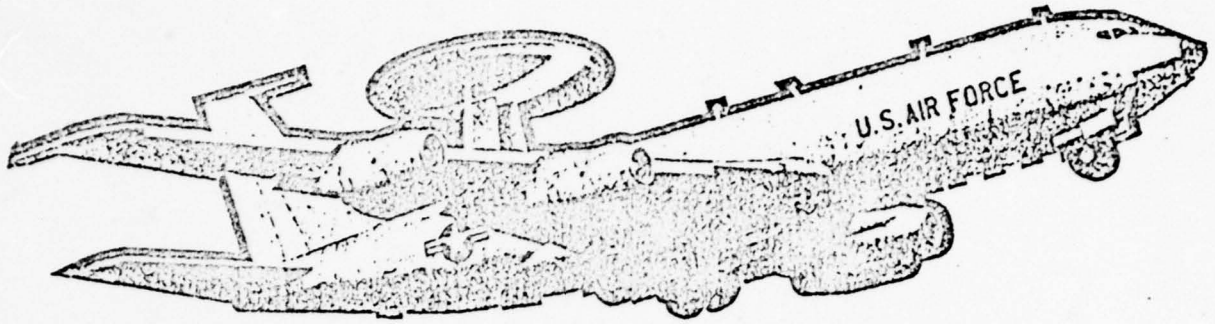
Appendix H

Samples From the 552nd AWACW Monthly Training Plan

Sample Title Page

552 AIRBORNE WARNING AND CONTROL WING

MONTHLY OPERATIONS TRAINING PLAN



MAY	JUNE	JULY

552 AWAC WING

JOHN L. PIOTROWSKI, Brig Gen, USAF
Commander

Sample Distribution List

DISTRIBUTION

ORGANIZATION	NO COPIES
552 AWACW/CC	2
552 AWACW/CV	1
552 AWACW CCA	1
552 AWACW/DO	1
552 AWACW/DOA	1
552 AWACW/DOB	1
552 AWACW/DOC	2
552 AWACW/DOT	1
552 AWACW/DOX	1
552 AWACW/DOV	1
552 AWACW/DOW	1
552 AWACW/DOTL	1
552 AWACW/DOTM	1
552 AWACW/DOTUD	2
552 AWACW/DOTS	2
552 AWACW/OA	2
552 AWACW/USCS	1
552 AWACW/FAA	1
552 AWACW/DOTU	10
552 AWACW/AD	1
552 AWACW/ASD	1
552 AWACW/RM	2
552 AWACW/SE	1
552 AWACW/IN	1
552 AWACW/TD	1
552 AWACW/TDO	1
552 AWACW/TDT	1
552 AWACW/TDS	1
552 AWACW/MA	1
552 AWACW/MAM	1
552 AWACW/MAMP	1
552 AWACW/MAVS	1
552 AWACW/MAT	1
552 AWACW/WE	2
963 AWACS	5
964 AWACS	10
965 AWACS	6
966 AWACTS	6
7ACCS/DO	6
2854 ABG/CC	1
2852 ABG/SP	1
2852 ABG/SV	1
1985 COMM SQ	1
413 FTD	1
USAF TFWC/DO	1
USAF TFWC/OLAC	1
BOEING/BLDG 230/L42	1
OC-ALC/MMEC (2)	1
OC-ALC/MMAHA	1
552 AWACW/ADLO	1
HQ TAC/DOA	6
HQ TAC/WAO	1
HQ ADCOM/DOC	2
HQ ADCOM/DOO	1
HQ ADCOM/DOS	1
MEMPHIS ARTCC/MLSO	1
8 AF/DOOK	2
15 AF/DOOK	2
2 BMW/DOOK	1
5 BMW/DOOK	1
7 BMW/DOOK	1
19 BMW/DOOK	1
22 BMW/DOOK	1
28 BMW/DOOK	1
42 BMW/DOOK	1
68 BMW/DOOK	1
92 BMW/DOOK	1
93 BMW/DOOK	1
96 BMW/DOOK	1
97 BMW/DOOK	1
319 BMW/DOOK	1
320 BMW/DOOK	1
379 BMW/DOOK	1
380 BMW/DOOK	1
410 BMW/DOOK	1
416 BMW/DOOK	1
509 BMW/DOOK	1
HQ TAC/LG/MF-3	1
9 AF/DOOO	1
12 AF/DOOO	1

Monthly Training Plan Legend

AD-A069 745 AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCH--ETC F/G 15/7
AN EVALUATION OF MAIN OPERATING BASE SCHEDULING PROCEDURES OF T--ETC(U)
MAR 79 L W SAUNDERS, J D YOUNT

UNCLASSIFIED AFIT/GST/SM/79M-6 NL

3 OF 3
AD
A069745

END
DATE
FILMED
7-79
DDC

Monthly Training Plan Legend

Mission Number Example K6M07
A-L: denote month, i.e. K=November
3,4,5,6: denote the squadron responsible, i.e. 6=966
M, L, P: denote sortie type, i.e. M=Mission or Exercise Sortie
XX: denotes the number of sorties that month, 07=The seventh sortie of the month.

Mission Times
All times are in local time with respect to Tinker AFB

Fuel Load
Given in thousands of pounds

Altitudes
Given in thousands of feet

Working Areas
Nicknames for the areas are used. These are from the Flight Planning Publication published by the Department of Defense. The times given for the E-3A are the amount of time it is to spend in the area. The "On Station Time" is given in Greenwich Mean Time('Z' time).

Duration
Total amount of time expected to fly the mission in hours and tenths of hours.

Controlling Agency
The ground based unit that will be responsible for maintaining radar separation or coordinating the wing's effort.

Frag Agency
The agency external to the unit that is responsible for supplying the resources and through which the crew can coordinate any training efforts.

Remarks
Any special information deemed necessary by the scheduler, i.e. Gallant Eagle is a code name for an exercise.

Sample Page From the Monthly Training Plan

DATE	MISSION NUMBER	TAKEOFF (LOCAL)	LANDING (LOCAL)	DURATION	FUEL TANK RAMP	1ST AR TRACK ARCT	2ND AR TRACK ARCT	TANK UNIT ALT	WORKING AREAS FIGHTER UNITS	TIME ON STATION DURATION	NUMBER OF FIGHTERS FRAG AGENCY
1	K4N01	0625	1715	10.6	40M 143M	12W 1500Z		319 260	ALBACORE BASS/COD 318FIS 123FIS	1700Z 4+00	12 25AD
CONTROLLING AGENCY: 25AD					REMARKS: LAND AT MCCHORD AFB (HON)						
1	K6N02	0650	1500	08.2		607		375	PRESCOTT RHEIALAADER	1430Z	12
					143M	1245		260	87FIS 171FIS	4+00	23AD
CONTROLLING AGENCY: 23AD					REMARKS:						
1	K6P01	0535	1435	08.0	20M 100M	111E/W 1530Z		931 260	LOCAL		
1	K3M03	1100		•					TBD	TBD Z	
CONTROLLING AGENCY:					143M REMARKS: GALLANT EAGLE						
1	K3P02	1635	2135	05.0	20M 90M	111E/W 2330Z		340 260	LOCAL		
2	K3P03	0850	1350	05.0	20M 90M	313S/N 1700Z		134 210	LOCAL		
2	K4M04	0945	1855	09.2	30M 143M	1AE 2100Z		940 250	ALBACORE/BASS/COD 318FIS/123/409FIS	1500Z 4+00	12 25AD
CONTROLLING AGENCY: 25AD					REMARKS: T/OFF FROM MCCHORD--LAND AT TINKER						
2	K4M05	1100		•					TBD	TBD Z	
CONTROLLING AGENCY:					143M REMARKS: GALLANT EAGLE						
2	K6M06	1515	0105	09.8	20M 143M	111E 2215Z		160 260	W122 4TFW	240 4+00	12 9AF
CONTROLLING AGENCY: 20AD					REMARKS:						
2	K6L01	1830	0030	06.0	20M 100M	12E/W 0230Z		5 260	LOCAL		
2	K4P04	1930	0130	06.0	20M 100M	1AE 0400Z		940 270	LOCAL		
2	K4801	2330	0700	07.5	40M 143M	204N 0830Z		416 290			
					REMARKS: DEPLOY TO DET 2						

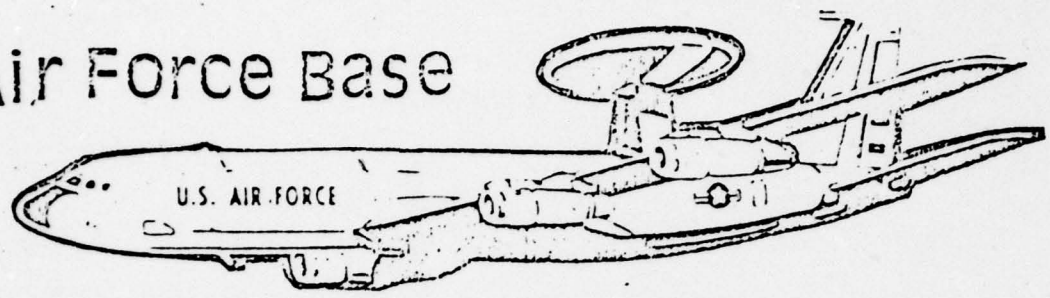
Appendix I

Samples From the 552nd AWACW Weekly Training Plan

Sample Title Page

552nd AIRBORNE WARNING AND CONTROL WING

Tinker Air Force Base



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WEEKLY AIRCRAFT FLYING AND MAINTENANCE SCHEDULE

DATE: 25 SEPT - 1 OCT 78

Roger R. Cowell

ROGER R. COWELL, COL. USAF
VICE COMANDER

Sample Table of Contents with
Its Distribution List for the
Weekly Schedule

TABLE OF CONTENTS

ORGANIZATION	NO COPIES
552 AWACW/CC	2
552 AWACW/CV	1
552 AWACW/CCE	1
552 AWACW/DO	2
552 AWACW/DOC	6
552 AWACW/DOT	6
552 AWACW/DOV	3
552 AWACW/DOW	1
552 AWACW/DOX	1
552 AWACW/DOTLO	1
552 AWACW/IN	1
552 AWACW/AD	1
552 AWACW/ADM	1
552 AWACW/ADO	1
552 AWACW/ADP	1
552 AWACW/ADR	1
552 AWACW/ADS	1
552 AWACW/SE	1
552 AWACW/TD	1
552 AWACW/TDP	1
552 AWACW/TDM	1
552 AWACW/RM	1
552 AWACW/MA	4
552 AWACW/MAA	15
552 AWACW/MAP	18

ORGANIZATION	NO COPIES
552 AWACW/MAL	1
552 AWACW/MAM	2
552 AWACW/MAO	14
552 AWACW/MAP	1
552 AWACW/MAQ	4
552 AWACW/MAT	2
552 AWACW/MAMJ	1
552 AWACW/MAMM	2
552 AWACW/MAMP	5
552 AWACW/CAMS/CC	2
552 AWACW/SOF	2
963 AWACS/CC	1
963 AWACS/DO	1
963 AWACS/DOS	1
963 AWACS/DOOF	6
963 AWACS/DOOM	1
964 AWACS/CC	6
966 AWACS/CC	10
413 FTD	1
1985 CS/FFAV	2
2854 ABG/CC	1
2854 ABG/SP	1
2854 ABG/DPM	1
2854 ABG/SV	1
552 WE	1

ORGANIZATION	NO COPIES
BASE OPS/OTM	1
AFTEC/DOU	3
OC-ALC/CC	1
OC-ALC/DS	2
OC-ALC/DSD	1
OC-ALC/DSEE	2
OC-ALC/DSDM	2
OC-ALC/DSMPP	2
OC-ALC/MMEC (2)	1
OC-ALC/MMAHA	1
BOEING (BLDG 230) L42	1
TAC/DOA	5
WESTINGHOUSE/RCS	1
ALC/DSDP	1
OKC RAPCON/TOWER (L8)	2

Sample Mission Coordination/
Planning Checklist Used by
the 552nd Scheduler

MISSION COORDINATION/PLANNING CHECKLIST

1. MSN#_____MSN DATE_____FRAG AGENCY_____AUTOVON/SAGE_____

   POC_____

2. MSN TYPE:A T PHASE II PHASE III DOTU PLANNER_____

   DATE INITIATED_____

3. PARTICIPATING FLYING UNITS:

FIGHTER/TANKER/OTHER	POC/AV/SAGE #	AC TYPE/#	REMARKS

4. GROUND RADAR BACKUP:_____

5. MSN DATA:	SCHEDULED	BRIEFED	REMARKS
TIME ON STATION/ACTIVITY PERIODS:			
DURATION:			
NUMBER OF FIGHTERS:			
NUMBER OF TARGETS:			
NUMBER ECM TARGETS:			
NUMBER OF TANKERS:			
OTHER:			

6. TYPE ACTIVITY:_____

   _____

7. WORKING AREA:_____

8. ORBIT AREA: ORBIT POINTS (if required)_____

   RADIAL/DME (if required)_____

   DESIGNATOR/DESCRIPTION_____

ORBIT AREA: continued REQUESTING AGENCY:_____

ARTCC INVOLVED: _____

PROVISION TO CREW: VIA FRAG VIA TELECON

9. ECM CLEARANCE:

REQUIRED?___WHAT BANDS?____WHO REQUESTS?____ACCOMPLISHED?___

10. TADIL A/MPC TRAINING:

SCHEDULED?_____IF SCHEDULED, WITH WHOM? OTHER MSN#_____

MPC_____

MPC POC/AV/SAGE# _____

_____

11. SPECIAL/ADDITIONAL REQUIREMENTS:_____

_____

12. OPS STOP PLANNED?_____WHERE?_____IFR SUP CHECKED?_____

ETA:_____ETD:_____DURATION:_____ (If applicable)

BASE OPS:_____RUNWAY:_____

_____FUEL MIX:_____

PPR:_____

SECURITY:_____

13. REFUELING DATA:

TANKER UNIT:_____TRACK/ANCHOR:_____ARCT:_____

FUEL ONLOAD:_____

14. COMPUTER FLIGHT PLAN: AVAILABLE?____ORDERED?_____

CFP#:_____

15. AIRCRAFT COMMANDER:_____

MISSION CREW CMDR:_____

16. CHANGES POSTED TO WEEKLY: PLANNER_____SCHEDULER_____

17. MISSION CNX?_____REASON:

Sample Weekly/Daily

Flying Schedule

CBD ID	CA	DATE	BASE CODE	WEEKLY/DAILY AIRCRAFT FLIGHT SCHEDULE	ORGANIZATION	FLIGHT/SECTION	AIRCRAFT MDS	DAY
A A	2	780505	WWYK		552 AWACW	OMB	E-3A/WC-135B	FRIDAY

SORTIE SEQ NO	AIRCRAFT I.D. NUMBER	SORTIE NO.	MSN	SCHEDULED TAKEOFF	SCHEDULED LANDING	SCHEDULED DURATION	PILOT / IP	NCC / INSTRUCTOR	FUEL	AR TKR / ARCT	TANKER C/S / ALT	WORKING AIRSPACE	FTR UNIT	REMARKS
001	0558	1	966 P-CON	0720	1450	7.5	KING HALVORSON B		40,000 100,000	3H W	D037-8/67 280	LOCAL		EXIT: EED VORTAC
002	0559	1	963 P-CON	0730	1130	4.0	MOLDENHAUER(C)		100,000			LOCAL		915 2
003	0559	2	966 P-CON	1530	1930	4.0	CORNWELL (B) HALVORSON (B		100,000			LOCAL		ATS
													SOF:	0500-1215 CERLITZ
														1215-1930 STERK
													MLO:	CAPT WARNER
														MSGT HARWELL

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Sample Weekly/Daily Flying

Schedule Coordination Sheet

WEEKLY/DAILY FLYING SCHEDULE COORDINATION

DATE AND TIME INITIATED: 26/0830L SEP 78

INITIATED BY: CAPT BRACE

RECEIVED BY: C

EQUIPMENT AFFECTED	SCHEDULE CHANGE	EFFECTIVE DATE
FG M30	CHANGE T/OFF FROM 0420 TO 0910	29SEP
	CHANGE LAND FROM 1455 TO 1930	
	CHANGE ARCT FROM 1150 TO 1610Z	
	CHANGE ONSTATION FROM 1330Z TO 1830Z	
	CHANGE FTR UNIT FROM 49/10FIS TO 1TFW	
	CHANGE WORKING AREA FROM MACI&J TO W-386	
	DUR 10.6 TO 10.3	
	REASON FOR CHANGE: DUE TO LOSS OF ACTIVITY	
	AT 21AD RESCHEDULED WITH 1TFW	

DECISION

OPERATIONS SCHEDULING OFFICER: Joseph M Rooks X ☑ APPROVED ☐ DISAPPROVED

MAINTENANCE CONTROL SUPERVISOR: SSgt Roberts X ☑ APPROVED ☐ DISAPPROVED

NOTIFICATIONS (As necessary)

AGENCY	NAME	TIME	AGENCY	NAME	TIME
DO 7241			WX ✓ 5242	Hawk	1230
TODAY 5443			AD ✓ 3071	MAJ HELLIGAN	1237
CC 7932			FIGHTER UNIT		
TODAY 5441			TANKER UNIT		
DOC HL			TRACK UNIT		
DOTUD 5155 ✓	Lindsey	1210	7ACCS		
963 3356			8TDCS		
964 6191			SOF SCHEDULE CHANGE: YES ,NO		
965 6081			SOF CHANGE ACCOMPLISHED		WJ
966 ✓ 5031	CAPT KING	0950			
IN 3047					

AF FORM JUN 72 2407

Sample Mission/Flight Simulator

Schedules

DATE	MISSION/FLIGHT SIMULATOR SCHEDULE			ORGANIZATION	FLIGHT/SECTION	DAY
27 SEP 78				552 AWACW	FLIGHT SUMULATOR	WEDNESDAY

MSN	SCHEDULED			CREW ORGANIZATION	SCHEDULING POINT OF CONTACT/ DUTY PHONE	EVENT SCHEDULED	REMARKS
	TAKEOFF	LANDING	DURATION				
	0001	0800	8.0	MA		SIM MAINT	
Q-10	0800	1000	2.0	78-13	CAPT KING 6031	LIFT SIM	
Q-10	1000	1200	2.0	78-14	CAPT KING 6031	LIFT SIM	
	1200	1230	.5	MA		VISUAL ALIGN	
Q-10	1230	1630	4.0	78-11	CAPT KING 6031		
	1630	2400	7.5			UNSCHEDULED	
		TOTAL	16.5				

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DATE	MISSION/FLIGHT SIMULATOR SCHEDULE				ORGANIZATION	FLIGHT/SECTION	DAY
2 MAY					552 AWACW	MSN SIM	TUESDAY
MSN	SCHEDULED			CREW ORGANIZATION	INSTRUCTOR TEAM CHIEF	CONFIGURATION	REMARKS
	TAKEOFF	LANDING	DURATION				
	0001	0400	4.0	M A	TSGT 5063 ROWELL		SIMULATOR MAINTENANCE
Q-22	0400	0700	3.0	OPS 3	LT 3856 CHRISTENSEN	12 SDC ADU 4PI	CONTINUATION TRAINING
Q-16	0700	0900	2.0	AVIS	CMS 7850 BRENMAN	12 SDC ADU 4PI	SAR FILM
Q-10	0900	1100	2.0	OPS 12	CAPT 3612 BOX	12 SDC ADU 4PI	W816S
Q-10	1100	1300	2.0	OPS 13	CAPT 3612 BOX	12 SDC ADU 4PI	W816S
Q-10	1300	1500	2.0	OPS 12/13	CAPT 3612 BOX	12 SDC ADU 4PI	W801RS
Q-10	1500	1700	2.0	OPS 14	CAPT 3612 BOX	12 SDC ADU 4PI	C124S
Q-10	1700	1900	2.0	OPS 15	CAPT 3612 BOX	12 SDC ADU 4PI	C124S
Q-34	1900	2200	3.0	ADME	CAPT 7879 RODI	12 SDC ADU 4PI	
Q-34	2200	2400	2.0	ADPD	CAPT 3395 CHAMPION	12 SDC ADU 4PI	
	TOTAL		24.0				

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DATE	MISSION/FLIGHT SIMULATOR SCHEDULE				ORGANIZATION	FLIGHT/SECTION	DAY
1 MAY					552 AWACW	DDTS	MONDAY
MSN	SCHEDULED			CREW ORGANIZATION	INSTRUCTOR TEAM CHIEF	CONFIGURATION	REMARKS
	TAKEOFF	LANDING	DURATION				
	0001	0600	6.0				UNSCHEDULED
Q-34	0600	0800	2.0	ADPA	CAPT 5462 NAYLOR	6 SDC 4PI	
Q-34	0800	0900	1.0	ADPS	MAJ 3916 LANGO	6 SDC 4PI	
Q-34	0900	1200	3.0	ADPD	CAPT 3724 CHAMPION	6 SDC 4PI	
Q-10	1200	1400	2.0	966	CAPT 3612 BARNES	6 SDC 4PI	
Q-34	1400	1600	2.0	ADPA	CAPT 5462 NAYLOR	6 SDC 4PI	
Q-34	1600	1800	2.0	ADPD	CAPT 3724 CHAMPION	6 SDC 4PI	
	1800	2000	2.0				UNSCHEDULED
	2000	2400	4.0	MA			SIMULATOR MAINTENANCE
	TOTAL		16.0				

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Weekly/Daily Scheduling Duties

of the AWACW Scheduling Office

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	WEEKEND
INITIAL COORDINATION with Tanker Units on Call Signs and ARCT's for two weeks hence schedule Change next weeks schedule as necessary Final Coordination with next weeks Tankers Initiate Weekly Flying Summary Report Build Schedule for Two Weeks hence	Type and Distribute Advance Copies of Two Weeks hence Schedule for meeting on Wednesday	FIRST SCHEDULING Meeting of Week -Next Week -Two Week's hence Schedules worked Assigned SOF Tours Get Tail Numbers from Maintenance Prepare Slides for Next Days Meeting Exchange Call Signs with Tanker Units and Pass to Maintenance for Printing Obtain Other Info for Sch. --Pass to Maintenance	SECOND SCHEDULING Meeting of Week -Transmit to TAC Weekly Flying Summary Report -After Meeting with Signed Copy send to Maintenance for Repro Correct any Slides for Wing/CC Meeting Initiate/ Transmit Requests for Orbits A/R	Begin Tanker Coordination for two weeks hence Initiate New Schedule for Next Weeks Schedule Distribute Weekly Schedule by 1500 Hours Relay Next Weeks Schedule to HQ/TAC	Work as Necessary Legend: Weekly Responsibilities of Major Rook's Assistant; Sgt. Blancard and his staff

Weekly Scheduling Duties of the AWACW Scheduling Office

Daily Scheduling Duties of 552nd AWACW

Scheduling Office

1. Coordinate Scheduling Changes with the Required Organizations.

2. Review and Prepare Daily Slides for Stand-up Briefing and Reproduce Copies for Files.

3. Review Incoming Mission Frags for Accuracy and Recompute and Coordinate any changes as necessary.

4. Sort out incoming message traffic and place in appropriate files for disposition. File and read all documentation concerning the AWACW scheduling system.

Appendix J

Sources of Changes to the AWACW Schedule for One Week

Sources of changes to the 552nd AWACW schedules.
The source is with respect to the wing.

Schedule involved:

Flying Schedule

External	Internal
Working Area(2)	Aircrew on Leave
Tanker(3)	Personnel Reasons within the Squadron
Training Sources	Maintenance(3)
Working Availability with respect to time	Aircrewman is sick
Weather(2)	Operational Commitments

NOTE: The number inside the parentheses denotes the number of times that reason occurred during that week.

Simulator Schedule

A change made to the flying schedule
Training required on personnel other than aircrew
VIP visit to the wing
Maintenance needed to be performed on simulator
Wing's mission support branch needed to work on the simulators computer tape

All these changes involved nine simulator periods

SOURCE: 552nd Wing schedule deviation reports for the week of 25-30 September 1978.

Vita

Larry W. Saunders was born in Princeton, West Virginia, on August 27, 1944. He graduated from high school in Princeton in 1962 and attended West Virginia University from which he graduated in 1966 with a Bachelor's Degree in Chemistry and a commission in the United States Air Force.

After completing navigator training at Mather Air Force Base, California, he operationally flew the B-52D at Pease Air Force Base, New Hampshire, and in Southeast Asia. He also was a Standardization/Evaluation instructor navigator in the B-52G at Seymour Johnson Air Force Base, North Carolina.

In 1972 he attended pilot training at Craig Air Force Base, Alabama. After graduation he flew the B-52H at Minot Air Force Base, North Dakota, serving as a Standardization/ Evaluation copilot, aircraft commander, and flight scheduler. He entered the Air Force Institute of Technology in August, 1977.

He is married to the former Pamela M. Mergen of Weirton, West Virginia. They have two sons, Craig and Bradley.

Permanent address: 112 South Belleview Drive
Weirton, West Virginia
26062

Vita

Joseph Dean Yount was born on 25 October 1949 in Washington, D.C. He graduated from high school in 1967. He attended the Military College of South Carolina, The Citadel, beginning in 1967 and graduated from that institution in May, 1971, with a Bachelor of Science in Mathematics. Following graduation he entered pilot training at Laughlin Air Force Base, Texas, receiving his wings in 1972. After a tour in Vietnam flying O-2's as a Forward Air Controller, he was assigned to the 509th/34th Air Refueling Squadrons at Pease Air Force Base, New Hampshire, where he served as a pilot and standardization scheduler in the KC-135 aircraft. He next was assigned to the 8th Tactical Deployment Control Squadron in June, 1976, at Seymour Johnson Air Force Base, North Carolina, where he served as a pilot and safety officer in the EC-135 aircraft. He was assigned to the School of Engineering, Air Force Institute of Technology in July, 1977.